NTNU

INTERNATIONAL MASTER´S PROGRAMMES 2014 - 2015

MASTER OF ARTS
MASTER OF PHILOSOPHY
MASTER OF SCIENCE

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For course descriptions see: http://www.ntnu.no/studies/courses

INTRODUCTION

This is a guide for students who are enrolled in one of the International Master's Degree Programmes at NTNU, and who are in the process of planning or completing their degree.
It contains an updated outline of the programmes for each of the individual International Master's Degrees.

As this catalogue is revised annually, only the latest edition is valid. This edition is valid until the end of the academic year 2014/2015.

Good luck with your studies,

Student and Academic Division

NORWEGIAN UNIVERSITY OF SCIENCE AND TECHNOLOGY (NTNU)

NTNU consists of 7 faculties. The University has over 20 000 students, and approximately 5 000 employees.

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

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

GUIDE TO THE INTERNATIONAL MASTER´S PROGRAMMES

Tables
The tables show the courses in relation to the overall degree programme. Here is a guide to the specific boxes:

Ex (Course year and time of examination)
This box states which course year and examination period this examination can be taken for the first time.
The examination period is marked “h” for the autumn examination and “v” for the spring examination.

Subject no.
The course code comprises 6 or 7 digits.

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

Note
This box includes any references to footnotes.

Cr (credits)
The credits give the weighting of each course in the degree programme. Credits are given according to the European Credit Transfer System (ECTS).

FACULTY OF NATURAL SCIENCES AND TECHNOLOGY

MSC-PROGRAMME IN CHEMICAL ENGINEERING
(MSCHEMENG)

Term 1 and 2

Ex	Subject no.	Subject title	Note	Cr	Comp./ Opt.
		Compulsory and optional courses	1		
1h	TKP4140	PROCESS CONTROL		7,5	v1
1h	TKP4155	REACTION KIN/CATALYS		7,5	v1
1h	TKP4160	TRANSPORT PHENOMENA		7,5	v1
1h	TKP4170	PROCESS DESIGN PROJ	2	7,5	v
1v	-	EXP IN TEAM INT PROJ		7,5	o
1v	TKP4115	SURFACE/COLLOID CHEM		7,5	v1
1v	TKP4130	POLYMER CHEMISTRY		7,5	v2
1v	TKP4135	CHEM PROC SYST ENG		7,5	v2
1v	TKP4145	REACTOR TECHNOLOGY		7,5	v2
1v	TKP4150	PETROCH/OIL REFINING		7,5	v2
1v	TKP4171	PROCESS DESIGN PROJ	2	7,5	v
		Supplementary courses	1		
1h	TBT4140	BIOCHEM ENGINEERING		7,5	v
1h	TMA4195	MATHEMATIC MODELLING		7,5	v
1h	TMA4215	NUMERIC MATHEMATICS		7,5	v
1h	TPG4105	PETROLEUM ENG BC		7,5	v
1h	TPG4140	NATURAL GAS		7,5	v
1h	TPK4120	SAFETY/RELIAB ANALYS		7,5	v
1v	KJ2053	CHROMATOGRAPHY		7,5	v
1v	TBT4125	FOOD CHEMISTRY		7,5	v
1v	TBT4130	ENVIRONM BIOTECH		7,5	v
1v	TEP4215	ENERGY AND PROCESS		7,5	v
1v	TEP4250	MULTIPHASE TRANSPORT		7,5	v
1v	TEP4265	THERM/PROC ENG		7,5	v
1v	TKJ4175	CHEMOMETRICS		7,5	v
1v	TKP4180	BIOFUELS/BIOREFIN		7,5	v2
1v	TKP4185	NUCLEAR POWER INTRO		7,5	v
1v	TKP4190	FABR/APPL NANOMAT		7,5	v
1v	TKT4140	NUM METH COMP LAB		7,5	v
1v	TMM4175	POLYMERS/COMPOSITES		7,5	v
1v	TPG4230	FIELD DEV/OPERATIONS		7,5	v
1v	TTK4135	OPTIMISATION/CONTROL		7,5	v
1V	TVM4145	WATER/WASTEW TREATM		7,5	v

o - compulsory courses
v - optional courses

v1 - at least 3 of these 4 courses must be selected
v2 - at least 1 of these courses must be selected

Ex 1h = Term 1, Exam Autumn
Ex 1v = Term 2, Exam Spring

1) The courses must be selected to obtain a total of 30 credits in each semester. Supplementary courses are not considered when planning the teaching and examination schedules.
2) The course must be chosen either in autumn (TKP4170) or in spring (TKP4171).

FACULTY OF NATURAL SCIENCES AND TECHNOLOGY

MSC-PROGRAMME IN CHEMICAL ENGINEERING
(MSCHEMENG)

Term 3 and 4

Ex	Subject no.	Subject title	Note	Cr
		Specialization courses	1	
2h	TKP4515	CATALYS/PETROCHEM SC		7,5
2h	TKP4525	COLL/POLYMER CHEM SC		7,5
2h	TKP4535	ENVIRONM/REACT TECH SC		7,5
2h	TKP4555	PROCESS SYST ENG SC		7,5
2h	TKP4565	PULP/PAPER BIOREFIN SC		7,5
		Specialization projects	1	
2h	TKP4510	CATALYS/PETROCHEM SP		15,0
2h	TKP4511	CATALYS/PETROCHEM SP		7,5
2h	TKP4520	COLL/POLYMER CHEM SP		15,0
2h	TKP4521	COLL/POLYMER CHEM SP		7,5
2h	TKP4530	ENVIRONM/REACT TECH SP		15,0
2h	TKP4531	ENVIRONM/REACT TECH SP		7,5
2h	TKP4550	PROCESS SYST ENG SP		15,0
2h	TKP4551	PROCESS SYST ENG SP		7,5
2h	TKP4560	PULP/PAPER BIOREFIN SP		15,0
2h	TKP4561	PULP/PAPER BIOREFIN SP		7,5
		Supplementary courses	2	
2h	TBT4140	BIOCHEM ENGINEERING		7,5
2h	TKP4140	PROCESS CONTROL		7,5
2h	TKP4155	REACT KIN/CATALYSIS		7,5
2h	TKP4160	TRANSPORT PHENOMENA		7,5
2h	TMA4195	MATHEMATIC MODELLING		7,5
2h	TMA4215	NUMERIC MATHEMATICS		7,5
2h	TPG4105	PETROLEUM ENG BC		7,5
2h	TPG4140	NATURAL GAS		7,5
2h	TPK4120	SAFETY/RELIAB ANALYS		7,5
2h	TVM4145	WATER/WASTEW TREATM		7,5
		Master Thesis		
2v	TKP4900	CHEM PROCESS TECHN		30,0

Ex 2h = Term 3, Exam Autumn
Ex 2v = Term 4, Master Thesis Spring

1) One specialization course and one specialization project must be selected. The specializations are within the following five main profiles:
   Catalysis and Petrochemistry
   Colloid and Polymer Chemistry
   Process Systems Engineering
   Environmental Technology and Reactor Technology
   Pulp & Paper and Biorefinery
2) Supplementary courses must be selected to obtain a total of 30 credits per semester. The courses are not considered when planning the teaching and examination schedules.

FACULTY OF INFORMATION TECHNOLOGY, MATHEMATICS AND ELECTRICAL ENGINEERING

MSC-PROGRAMME IN ELECTRIC POWER ENGINEERING (MSELPOWER)

Term 1, 2, 3 and 4

Ex	Subject no.	Subject title	Note	Cr	Comp/ Opt.
		Compulsory and optional courses	1		
1h	TEP4235	ENERGY MANAGEM BUILD		7,5	v
1h	TET4115	POWER SYST ANALYSIS		7,5	v1
1h	TET4160	INSULATING MATERIALS		7,5	v1
1h	TET4165	LIGHT AND LIGHTING		7,5	v
1h	TET4190	POWER ELECTRONICS		7,5	v1
1h	TET5100	POWER ENG UPDATES		7,5	o
1h	TPK4120	SAFETY/REAL ANALYSIS		7,5	v
1v	-	EXP IN TEAM INT PROJ		7,5	o
1v	TEP4220	ENERGY/ENV CONSEQUEN	2	7,5	v
1v	TET4120	ELECTR DRIVES		7,5	v2
1v	TET4135	ENERGY PLANNING		7,5	v2
1v	TET4170	EL INSTALLATIONS	2	7,5	v2
1v	TET4175	DES/OPER SMART GRID		7,5	v2
1v	TET4180	EL POW SYST STAB		7,5	v2
1v	TET4185	POWER MARKETS	2	7,5	v2
1v	TET4195	HIGH VOLTAGE EQUIPM		7,5	v2
1v	TET4200	MAR OFFSH POW SYST		7,5	v2
2h	TET4165	LIGHT AND LIGHTING		7,5	v
2h	TET5500	EL POWER ENG SP		15,0	o
2h	TET5505	EL POWER ENG SC		7,5	o
2h	TPK4120	SAFETY/REL ANALYSIS		7,5	v
2h	TPK5100	PROJ PLAN/CONTR		7,5	v
		Master Thesis			
2v	TET4910	ELEC POW ENG		30,0	o

o - compulsory courses
v - optional courses

v1 - at least two of these courses must be chosen
v2 - at least two of these courses must be chosen

Ex 1h = Term 1, Exam Autumn
Ex 1v = Term 2, Exam Spring
Ex 2h = Term 3, Exam Autumn
Ex 2v = Term 4, Master Thesis Spring

1) In addition to the compulsory courses, the student must select courses so that the requirement of 60 credits pr year is met. Available courses are listed in the table. Other relevant courses may be accepted after application.
2) The course is not considered when planning the teaching and examination schedules.

FACULTY OF ENGINEERING SCIENCE AND TECHNOLOGY

MSC-PROGRAMME IN GEOTECHNICS AND GEOHAZARDS (MSGEOTECH)

Term 1, 2, 3 and 4

Ex	Subject no.	Subject title	Note	Cr
		Compulsory courses		
1h	TBA4110	GEOTECH FIELD/LAB IN		7,5
1h	TBA4231	APPLIED GEOMATICS		7,5
1h	TBA5100	THEORETICAL SOIL MEC		7,5
1h	TBA5150	GEOHAZARDS/RISK AN		7,5
1v	-	EXP IN TEAM INT PROJ		7,5
1v	TBA4335	HIGHW PLAN/PAVE TECH	1	7,5
1v	TBA5155	FOUNDATIONS/SLOPES		7,5
1v	TGB5110	GEOLOGY TUNNELL BC		7,5
1v	TKT4201	STRUCTURAL DYNAMICS	1	7,5
2h	TBA4116	GEOTECH ENG AC		7,5
2h	TBA4510	GEOTECH ENG SP	2	7,5
2h	TGB5100	ROCK ENGINEERING AC		7,5
2h	-	ELECTIVE COURSE	3	7,5
		Master Thesis		
2v	TBA4900	GEOTECH ENGINEERING		30,0

Ex 1h = Term 1, Exam Autumn
Ex 1v = Term 2, Exam Spring
Ex 2h = Term 3, Exam Autumn
Ex 2v = Term 4, Master Thesis Spring

1) One of the courses TBA4335 and TKT4201 must be chosen.
2) The primary choice is the combination TBA4510 (7,5 cr) together with an elective course (7,5 cr). In some case, when an appropriate elective course is hard to find, the combination may be exchanged with the 15 cr course TBA4511 Geotechnical Engineering, Specialization Project. This must be done in agreement with the project supervisor.
3) A technical or project-related course must be chosen.

FACULTY OF ENGINEERING SCIENCE AND TECHNOLOGY

MSC-PROGRAMME IN GLOBAL MANUFACTURING MANAGEMENT (MSGLOMAN)

Term 1 and 2
Term 3 and 4 2015/16

Ex	Subject no.	Subject title	Note	Cr	Specialization 1	Specialization 2
		Compulsory and optional courses				
1h	GEOG3518	KNOW MANAG GLOB ECO		7,5	o	o
1h	TIØ4146	FIN SCIENC TECHN STUD		7,5	o	o
1h	TIØ4265	STRATEGIC MANAGEM		7,5	-	o
1h	TPK4160	VALUE CHAIN CONTR		7,5	o	-
1h	TPK4165	ERP/PLM SYSTEMS		7,5	o	o
1v	-	EXP IN TEAM INT PROJ		7,5	o	o
1v	SANT3508	GLOB THEORY/CULTURE		7,5	o	o
1v	TIØ4175	PURCH/LOG MANAGEM		7,5	-	o
1v	TPK4135	MANUFACT LOGISTICS		7,5	v	-
1v	TPK4180	MANUFACT STRATEGY		7,5	o	o
1v	TPK4185	IND SYST ENG		7,5	v	-
2h	TIØ4195	ENV MANAGEM/CORP GOV		7,5	o	o
		Specialization courses				
2h	IØ3091	STRAT PURCH MAN SC		7,5	-	o
2h	TPK4430	PROD MANAG/LOG SC		7,5	o	-
		Specialization projects				
2h	IØ3092	STRAT PURCH MAN SP		15,0	-	o
2h	TPK4530	PROD MANAGEMENT SP		15,0	o	-
		Master Thesis				
2v	IØ3910	GLOBALIZATION		30,0	-	o
2v	TPK4930	PRODUCTION MANAGEMENT		30,0	o	-

Ex 1h = Term 1, Exam Autumn
Ex 1v = Term 2, Exam Spring
Ex 2h = Term 3, Exam Autumn
Ex 2v = Term 4, Master Thesis Spring

Specialization:
1 Production Management
2 Purchasing Management

FACULTY OF ENGINEERING SCIENCE AND TECHNOLOGY

MSC-PROGRAMME IN HYDROPOWER DEVELOPMENT
(MSB1)

Term 1, 2, 3 and 4

Ex	Subject no.	Subject title	Note	Cr
		Compulsory courses		
1h	TVM4105	HYDROLOGY		7,5
1h	TVM5115	DAM ENGINEERING		7,5
1h	TVM5125	HYDRAULIC DESIGN		7,5
1h	TVM5135	PLANNING HYDROPOWER		7,5
1v	-	EXP IN TEAM INT PROJ		7,5
1v	TGB5110	GEOLOGY TUNNELL BC		7,5
1v	TVM5132	PREF STUDY HYDRO DEV		7,5
1v	TVM5140	ECON ASSESM HYDROPOW		7,5
2h	TGB5100	ROCK ENGINEERING AC		7,5
2h	TVM4106	HYDRO MODELLING		7,5
2h	TVM5160	HEADWORKS/SEDIMENT		7,5
2h	TVM5171	WATER RES MANAGEMENT		7,5
		Master Thesis	1	
2v	TBA4910	PROJ MANAGEMENT		30,0
2v	TGB4910	ROCK ENGINEERING		30,0
2v	TVM4915	HYDROPOWER DEVELOPMENT		30,0

Ex 1h = Term 1, Exam Autumn
Ex 1v = Term 2, Exam Spring
Ex 2h = Term 3, Exam Autumn
Ex 2v = Term 4, Master Thesis Spring

1) Choose one of the thesis.

FACULTY OF ENGINEERING SCIENCE AND TECHNOLOGY

MSC-PROGRAMME IN INDUSTRIAL ECOLOGY (MSINDECOL)

Term 1, 2, 3 and 4

Ex	Subject no	Subject title	Note	Cr
		Compulsory courses		
1h	TEP4223	LIFE CYCLE ASSESS		7,5
1h	TEP4285	MATERIAL FLOW ANALYS		7,5
1h	TEP4300	CLIMATE MITIGATION		7,5
1h	TIØ4265	STRATEGIC MANAGEMENT		7,5
1v	-	EXP IN TEAM INT PROJ		7,5
1v	SØK1101	ENVIRONM RESOURCE		7,5
		Optional courses	1	
1v	TEP4220	ENERGY/ENV CONSEQUEN	2	7,5
1v	TEP4222	INPUT-OUTPUT ANALYS	2	7,5
1v	TEP4290	MODEL BUILT ENV SYST	3	7,5
1v	TIØ5215	GLOB GOV SUST SUPPLY	4	7,5
1v	TPD5100	SUS PROD DES AC	5	7,5
1v	POL1003	POLITICS ENVIRONMENT	6	7,5
1v	POL3004	RESEARCH DESIGN	6,7	7,5
		Optional courses	1	
2h	TIØ4146	FIN SC/TECHN STUD	7	7,5
2h	TIØ4195	ENV MANAGEMENT/CG		7,5
2h	TIØ4201	RISK GOVERNANCE		7,5
2h	TIØ4525	SAFE HEALTH/ENV SC	4	7,5
2h	TPD4505	DESIGN THEORY SC	5	7,5
2h	TPK4160	VALUE CHAIN CONTR		7,5
2h	POL3507	POLICY ANALYSIS		15,0
2h	SOS1002	RESEARCH METHODS	8	15,0
		Project and thesis preparation courses	9	
2h	TBA4580	IND ECOL PROJECT		15,0
2h	TEP5100	IND ECOL PROJECT		15,0
2h	TIØ5235	IND ECOL PROJECT		15,0
2h	TPD4190	DESIGN PROJECT		15,0
2h	POL3520	IND ECOL PROJECT		15,0
		Master Thesis	10	
2v	TBA4950	INDUSTRIAL ECOLOGY		30,0
2v	TEP4930	INDUSTRIAL ECOLOGY		30,0
2v	TIØ4955	INDUSTRIAL ECOLOGY		30,0
2v	TPD4910	INDUSTRIAL ECOLOGY		30,0
2v	POL3920	INDUSTRIAL ECOLOGY		30,0

Ex 1h = Term 1, Exam Autumn
Ex 1v = Term 2, Exam Spring
Ex 2h = Term 3, Exam Autumn
Ex 2v = Term 4, Master Thesis Spring

1) The courses are selected so that the total weighting each term amounts to 30 credits (Cr). Other optional courses may be chosen from the NTNU courses if there is not a conflict with respect to exam dates. The combination of optional courses must be approved by the programme.
2) This course is compulsory if a student chooses a thesis in TEP4930.
3) The course will not be taught in the academic year 2014/15.
4) This course is compulsory if a student chooses a thesis in TIØ4955.
5) This course is compulsory if a student chooses a thesis in TPD4910.
6) This course is compulsory if a student chooses a thesis in POL3920.
7) The course is not considered when planning the teaching and examination schedules.
8) If a student chooses a thesis in POL3920 and does not have this course or a similar one in his bachelor's degree, this course is compulsory.
9) The student chooses one of these, and the choice must be approved by the programme taking into account the background of the student.
10) The student chooses one of these, and the choice must be approved by the programme taking into account the background of the student.

FACULTY OF INFORMATION TECHNOLOGY, MATHEMATICS AND ELECTRICAL ENGINEERING

MSC-PROGRAMME IN INFORMATION SYSTEMS
(MSINFOSYST)

Term 1, 2, 3 and 4

Ex	Subject no.	Subject title	Note	Cr	Specialization 1	Specialization 2
		Compulosory and optional courses	1			
1h	TDT4237	SOFTWARE SECURITY		7,5	v	-
1h	TDT4245	COOPERATION TECHN		7,5	v	v
1h	TDT4250	MODEL-DRIVEN DEV IS		7,5	o	o
1h	TDT4290	CUSTOMER DRIVEN PROJ		15,0	o	o
1h	TPK5100	PROJ PLAN/CONTR		7,5	v	v
1v	-	EXP IN TEAM INT PROJ		7,5	o	o
1v	TDT4215	WEB INTELLIGENCE		7,5	o	o
1v	TDT4240	SOFTWARE ARCHITECT		7,5	v	v
1v	TDT4242	REQUIREMENT TEST		7,5	v	v
1v	TDT4252	ENTERPR MOD/ARC		7,5	v	o
1v	TTM4115	ENG DIST REAL SYST		7,5	v	-
2h	TDT4501	COMPUTER SCIENCE SP		15,0	o	o
2h	TDT4506	COMPUTER SCIENCE SC		7,5	o	o
2h	TBA5200	PROJ PLAN/ANALYSIS		7,5	v	v
2h	TDT4210	HEALTHCARE INFORM		7,5	v	v
2h	TIØ4180	INNOV MANAGEM		7,5	v	-
2h	IT1000	SURGEOM		7,5	v	v
2h	IT3010	RESEARCH METHODOLOGY		7,5	v	-
		Master Thesis				
2v	TDT4900	COMPUTER SCIENCE		30,0	o	o

o - compulsory courses
v - optional courses

Ex 1h = Term 1, Exam Autumn
Ex 1v = Term 2, Exam Spring
Ex 2h = Term 3, Exam Autumn
Ex 2v = Term 4, Master Thesis Spring

1) Optional courses must be selected to obtain a total of 30 credits in each semester.

Specialization:
1 Information Systems
2 Information Systems Engineering*

*Possible for students accepted for this specialization to have the 3rd semester at one of the other EUROMISE universities (NTNU, KTH, UPValencia, Politechnico Milano, UnivDelft, Twente, Sorbonne, Tech Univ Catalonia).

FACULTY OF NATURAL SCIENCE AND TECHNOLOGY

NORDIC MASTER'S PROGRAMME IN INNOVATIVE SUSTAINABLE ENERGY ENGINEERING (MSISEE)

Term 1 and 2*

SYSTEM INTEGRATION OF WIND POWER

Ex	Subject no.	Subject title	Note	Cr
		Compulsory courses		
1h	TET4115	POWER SYSTEM ANALYS		7,5
1h	TET4190	POWER ELECTR REN ENER		7,5
1h	TEP4175	ENERGY WIND TIDAL		7,5
1v	TEP4220	ENERGY/ENV CONSEQ		7,5
1v	TET4175	DES/OPER SMART GRID		7,5
1v	TET4185	POWER MARK RES/ENV		7,5
		Optional courses	1	
1h	TEP4223	LIFE CYCLE ASSESSM		7,5
1h	TEP4240	SYSTEM SIMULATION		7,5
1h	TIØ4556	ENERGY MARKETS SC		7,5
1v	-	EXP IN TEAM INT PROJ		7,5
1v	TET4135	ENERGY/SYST PLAN/OP		7,5
1v	TET4180	ELECT POW SYST STAB		7,5
1v	TET4200	MAR/OFFSH POW SYST		7,5

Ex 1h = Term 1, Exam Autumn
Ex 1v = Term 2, Exam Spring

1) Optional courses must be selected to obtain a total of 30 credits in each semester.

The Innovative and Sustainable Energy Engineering (ISEE) programme is a joint Nordic master programme between six Nordic Universities in five Nordic Countries.

* The second year, term 3 and 4, are taught at the Technical University of Denmark (DTU).

For further information see
www.msisee.org
www.ntnu.edu/studies/msisee

FACULTY OF NATURAL SCIENCE AND TECHNOLOGY

NORDIC MASTER'S PROGRAMME IN INNOVATIVE SUSTAINABLE ENERGY ENGINEERING (MSISEE)

Term 3 and 4*

SOLAR CELL SYSTEMS AND MATERIALS

Ex	Subject no	Subject title	Note	Cr
		Optional courses	1	
2h	FY3114	FUNC MATERIALS	2	7,5
2h	TFE4145	SEMICON PHYS/ELECTR	2	7,5
2h	TFY4255	MATERIALS PHYSICS	2	7,5
2h	TFY4300	ENERGY/ENV PHYSICS	2	7,5
2h	TMT4322	SOLAR CELLS/PHOTO	2,3	7,5
2h	TMT4326	REFIN/RECYC METALS	3	7,5
2h	TMT4330	RESOU ENERG/ENVIR	3	7,5
		Specialization projects	4	
2h	TFYxxxx	SEMESTER PROJECT		15,0
2h	TMTxxxx	SEMESTER PROJECT		15,0
		Master Thesis	5	
2v	TFY49xx	SOLAR CELL SYST/MATR		30,0
2v	TMT49xx	SOLAR CELL SYST/MATR		30,0

Ex 2h = Term 3, Exam Autumn
Ex 2v = Term 4, Master Thesis Spring

1) Optional courses must be selected to obtain a total of 30 credits in each semester.
2) Optional courses available for students choosing the Physics specialization.
3) Optional courses available for students choosing the Materials specialization.
4) One specialization project must be chosen according to the selected specialization.
5) The master thesis must be chosen according to the selected specialization.

The Innovative and Sustainable Energy Engineering (ISEE) programme is a joint Nordic master programme between six Nordic Universities in five Nordic Countries.

* The first year, term 1 and term 2 are taught at the Technical University of Denmark (DTU).

For further information see
www.msisee.org
www.ntnu.edu/studies/msisee

FACULTY OF NATURAL SCIENCES AND TECHNOLOGY

MSC-PROGRAMME IN LIGHT METALS, SILICON AND FERROALLOY PRODUCTION (MSLISIFER)

Term 1, 2, 3 and 4

LIGHT METALS, SILICON AND FERROALLOY PRODUCTION

Ex	Subject no.	Subject title	Note	Cr
		Compulsory courses		
1h	TMT4145	CERAMIC ENGINEERING		7,5
1h	TMT4155	HETEROGEN EQUILIBRIA		7,5
1h	TMT4306	MET PROD FERROALLOY		7,5
1h	TMT4330	RES ENERGY ENVIRONM		7,5
1v	TMT4208	FLUID/HEAT TRANSF AC		7,5
1v	TMT4252	ELECTROCHEMISTRY		7,5
1v	TMT4850	EXP IN TEAM INT PROJ		7,5
		Optional courses	1	
1v	TMT4166	EXP MATR/ELECTR CHEM		7,5
1v	TMT4335	CARBON MAT TECHN		7,5
		Compulsory courses		
2h	TMT4253	ELECTROCHEM PROCESS		7,5
2h	TMT4326	REFIN/RECYL METALS		7,5
2h	TMT5500	PROC MET ELECTR SP		15,0
		Master Thesis		
2v	TMT4905	MATR TECHN		30,0

Ex 1h = Term 1, Exam Autumn
Ex 1v = Term 2, Exam Spring
Ex 2h = Term 3, Exam Autumn
Ex 2v = Term 4, Master Thesis Spring

1) Select one of the courses.

FACULTY OF NATURAL SCIENCES AND TECHNOLOGY

MSC-PROGRAMME IN LIGHT METALS, SILICON AND FERROALLOY PRODUCTION (MSLISIFER)

Term 1, 2
Term 3 and 4 (2015/16)

PHYSICAL METALLURGY AND DOWNSTREAM PROCESSING

Ex	Subject no.	Subject title	Note	Cr
		Compulsory courses		
1h	TMT4155	HETEROGEN EQUILIBRIA		7,5
1h	TMT4222	MECH PROP METALS		7,5
1h	TMT4330	RES ENERGY ENVIRONM		7,5
1v	TMT4210	MATR PROC MODELLING		7,5
1v	TMT4266	MET FORM MICROSTRUC		7,5
1v	TMT4300	LIGHT ELECT MICROSC		7,5
1v	TMT4850	EXP IN TEAM INT PROJ		7,5
		Optional courses	1	
1h	TMM4160	FRACTURE MECHANICS		7,5
1h	TMM4165	JOINING TECHNOLOGY		7,5
1h	TMT4145	CERAMIC ENGINEERING		7,5
1h	TMT4242	STEEL OFFSHORE		7,5
1h	TMT4255	CORROSION PROTECTION		7,5
		Supplementary courses	1	
1h	TMM4195	FATIGUE DESIGN		7,5
1h	TMT4253	ELECTROCHEM PROCESS		7,5
		Compulsory courses		
2h	TMT4260	MOD PHASE TRANSFORM		7,5
2h	TMT4500	MATERIALS TECHN SP		15,0
		Supplementary courses	1	
2h	TMM4160	FRACTURE MECHANICS		7,5
2h	TMM4165	JOINING TECHNOLOGY		7,5
2h	TMM4195	FATIGUE DESIGN		7,5
2h	TMT4145	CERAMIC ENGINEERING		7,5
2h	TMT4242	STEEL OFFSHORE		7,5
2h	TMT4253	ELECTROCHEM PROCESS		7,5
2h	TMT4255	CORROSION PROTECTION		7,5
2h	TMT4515	CHEM METH SYNT SC		7,5
		Master Thesis		
2v	TMT4905	MATR TECHN		30,0

Ex 1h = Term 1, Exam Autumn
Ex 1v = Term 2, Exam Spring
Ex 2h = Term 3, Exam Autumn
Ex 2v = Term 4, Master Thesis Spring

1) Optional/supplementary courses must be selected to obtain a total of 30 credits in each semester. Supplementary courses are not considered when planning the teaching and examination schedules.

FACULTY OF ENGINEERING SCIENCE AND TECHNOLOGY

MSC-PROGRAMME IN MARINE TECHNOLOGY (MSN1)

Term 1, 2, 3 and 4

Ex	Subject no.	Subject title	Note	Cr	Specialization						
					MS	MC	MH	ME	MO	MD	MR
		Compulsory and optional courses	1								
1h	TEP4156	VISCOUS FLOWS		7,5	-	-	v	-	-	-	-
1h	TEP4165	COMP HEAT/FLUID FLOW		7,5	-	-	-	v	-	-	-
1h	TEP4185	NATURAL GAS TECHN		7,5	-	-	-	v	-	-	-
1h	TMM4112	MACHINE ELEMENTS		7,5	-	-	-	v	-	-	-
1h	TMR4115	DESIGN METHODS		7,5	-	-	v	v	v	o	v
1h	TMR4130	RISK ANALYSIS		7,5	v	-	-	-	o	o	v
1h	TMR4137	SUST UTIL MAR RES		7,5	-	-	-	-	-	v	o
1h	TMR4190	FINITE ELEM METH		7,5	o	-	o	-	-	v	-
1h	TMR4200	FATIGUE/FRACTURE		7,5	v1	-	-	-	-	-	-
1h	TMR4215	SEA LOADS		7,5	o	o	o	-	-	-	v
1h	TMR4235	STOCK THEORY SEALOADS		7,5	v	-	v	-	-	-	-
1h	TMR4240	MARINE CONTROL SYST 1		7,5	-	o	-	v	-	-	-
1h	TMR4260	SAFE OPER/MAINTEN		7,5	-	-	-	o	o	o	v
1h	TMR4275	MOD/SIM/AN DYN SYS		7,5	-	o	v	o	v	v	v
1h	TMR4320	SIM BASED DESIGN		7,5	o	v3	o	-	-	-	-
1h	TPK4120	SAFETY/RELIA ANALYSIS		7,5	-	-	-	-	o	v	-
1h	TTK4115	LINEAR SYST THEORY		7,5	-	v3	-	-	-	-	-
1v	-	EXP IN TEAM INT PRO		7,5	o	o	o	o	o	o	o
1v	TEP4170	HEAT AND COMB TECH		7,5	-	-	-	v	-	-	-
1v	TEP4215	ENERGY UTIL		7,5	-	-	-	v	-	-	-
1v	TMR4120	UNDERWATER ENG BC		7,5	-	-	-	-	-	v	-
1v	TMR4125	SHIP BUILDING		7,5	v	-	-	-	v	v	v
1v	TMR4135	MAR DES ADV VES/MET		7,5	-	-	-	-	v	o	o
1v	TMR4140	DES MAR PROD PLANS		7,5	-	-	-	-	-	-	o
1v	TMR4170	MARINE STRUCTURES		7,5	v2	-	-	-	-	-	-
1v	TMR4182	MARINE DYNAMICS		7,5	o	o	o	-	-	-	v
1v	TMR4195	DESIGN OFFSHOR STRUC		7,5	o	-	v	-	-	-	-
1v	TMR4205	BUCKLING/COLLAPS STR		7,5	v1	-	-	-	-	-	-
1v	TMR4217	HYDRO HIGH-SPEED VEH		7,5	-	v	v	-	-	-	-
1v	TMR4220	NAVAL HYDRODYNAMICS		7,5	-	v	v	v	-	v	v
1v	TMR4222	MACH/MAINTEN		7,5	-	-	-	-	v	-	-
1v	TMR4225	MARINE OPERATIONS		7,5	v	v	v	-	v	v	-
1v	TMR4230	OCEANOGRAPHY		7,5	-	-	v	-	-	-	-
1v	TMR4243	MAR CONTR SYST II		7,5	-	o	-	-	-	-	-
1v	TMR4280	INT COMB ENGINES		7,5	-	-	-	o	v	-	-
1v	TMR4290	MAR ELECTR PROP SYST		7,5	-	v	-	o	-	v	v
1v	TMR4315	PIPE SYSTEM DESIGN		7,5	-	-	-	v	v	-	-
		Supplementary courses	1,2								
1h	BI3061	BIOL OCEAN		7,5	-	-	-	-	-	v	v
1h	TEP4185	NATURAL GAS TECHN		7,5	-	-	-	-	-	v	v
1h	TMM4112	MACHINE ELEMENTS		7,5	-	-	-	-	v	-	v
1h	TMR4200	FATIGUE/FRACTURE		7,5	-	-	v	-	v	-	-
1h	TMR4320	SIM BASED DESIGN		7,5	-	-	-	-	-	-	v
1h	TPK5100	PROJ PLAN/CONTR		7,5	-	-	-	-	-	-	v
1h	TTT4175	MARIN ACOUSTIC		7,5	-	-	-	-	-	v	v
1v	TEP4112	TURBULENT FLOWS		7,5	-	-	v	-	-	-	-
1v	TEP4220	ENERGY/ENVIRONMENT		7,5	-	-	-	-	-	-	v
1v	TMA4275	LIFETIME ANALYSIS		7,5	-	-	-	-	v	-	-
1v	TMR4120	UNDERWATER ENG BC		7,5	-	-	-	-	v	-	v
1v	TMR4220	NAVAL HYDRODYNAMICS		7,5	v	-	-	-	-	-	-
1v	TMR4230	OCEANOGRAPHY		7,5	-	v	-	-	-	-	v
1v	TMR4243	MAR CONTR SYST II		7,5	-	-	-	v	-	-	-
1v	TMR4280	INT COMB ENGINES		7,5	-	-	-	-	-	-	v
1v	TPG4200	SUBSEA PROD SYST		7,5	-	-	-	-	v	-	-
1v	TPK4110	QUAL/PERF MANAGEMENT		7,5	-	-	-	-	v	-	v
1v	TTK4135	OPTIMISATION/CONTROL		7,5	-	v	-	-	-	-	-

cont.

FACULTY OF ENGINEERING SCIENCE AND TECHNOLOGY

MSC-PROGRAMME IN MARINE TECHNOLOGY (MSN1)

Ex	Subject no.	Subject title	Note	Cr	Specialization						
					MS	MC	MH	ME	MO	MD	MR
		Specialization courses									
2h	TMR4505	MARINE STRUCTURE SC		7,5	o	-	-	-	-	-	-
2h	TMR4515	MAR CONTR SYST SC		7,5	-	o	-	-	-	-	-
2h	TMR4525	MARINE HYDRODYN SC		7,5	-	-	o	-	-	-	-
2h	TMR4535	MARINE ENGINEER SC		7,5	-	-	-	o	-	-	-
2h	TMR4555	OPERATION MAIN ENG SC		7,5	-	-	-	-	o	-	-
2h	TMR4565	MARINE SYS DESIGN SC		7,5	-	-	-	-	-	o	-
2h	TMR4575	MARINE RES/AQUA SC		7,5	-	-	-	-	-	-	o
		Specialization projects									
2h	TMR4500	MARINE STRUCTURE SP		7,5	o	-	-	-	-	-	-
2h	TMR4510	MAR CONTR SYST SP		7,5	-	o	-	-	-	-	-
2h	TMR4520	MARINE HYDRODYN SP		7,5	-	-	o	-	-	-	-
2h	TMR4530	MARINE ENGINEER SP		7,5	-	-	-	o	-	-	-
2h	TMR4550	OPERATION MAIN ENG SP		7,5	-	-	-	-	o	-	-
2h	TMR4560	MARINE SYS DESIGN SP		7,5	-	-	-	-	-	o	-
2h	TMR4570	MARINE RES/AQUA SP		7,5	-	-	-	-	-	-	o
		Supplementary courses	1,2								
2h	BI3061	BIO OCEANOGRAPHY		7,5	-	-	-	-	-	v	v
2h	TEP4156	VISCOUS FLOWS		7,5	-	-	v	-	-	-	-
2h	TEP4165	COMP HEAT/FLUID FLOW		7,5	-	-	-	v	-	-	-
2h	TEP4185	NATURAL GAS TECHN		7,5	-	-	-	v	-	v	v
2h	TEP4212	GAS CLEAN/EMISS CONTR		7,5	-	-	-	v	-	-	-
2h	TIØ4120	OP RESEARCH INTRO		7,5	-	-	-	-	v	-	v
2h	TIØ4130	OPT METHODS		7,5	-	-	-	-	-	v	-
2h	TMM4112	MACHINE ELEMENTS		7,5	-	-	-	v	v	-	-
2h	TMR4115	DESIGN METHODS		7,5	-	-	v	-	-	-	v
2h	TMR4130	RISK ANALYSIS		7,5	v	-	-	v	-	-	v
2h	TMR4137	SUST UTIL MAR RES		7,5	-	-	-	-	v	v	-
2h	TMR4190	FINITE ELEMENT METHOD		7,5	-	v	-	-	-	v	-
2h	TMR4200	FATIGUE/FRACTURE		7,5	v	-	v	-	v	v	-
2h	TMR4215	SEA LOADS		7,5	-	-	-	-	v	v	v
2h	TMR4235	STOCH THEORY SEALOAD		7,5	v	-	v	-	-	-	-
2h	TMR4260	SAFE OPER MAINT		7,5	-	-	-	-	-	-	v
2h	TMR4275	MOD/SIM/AN DYN SYS		7,5	-	-	v	-	v	v	v
2h	TMR4300	EXP/NUM HYDRODYN		7,5	-	-	v	-	-	-	-
2h	TMR4305	ADV ANALY MAR STRUCT		7,5	v	-	-	-	-	-	-
2h	TPK4160	VALUE CHAIN CONTROL		7,5	-	-	-	-	-	v	v
2h	TPK5100	PROJ PLAN/CONTR		7,5	-	-	-	-	v	v	v
2h	TTK4115	LINEAR SYST THEORY		7,5	-	v	-	v	-	-	-
2h	TTK4150	NONLINEAR CONTR SYST		7,5	-	v	-	-	-	-	-
2h	TTK4190	GUIDANCE/CONTROL		7,5	-	v	-	-	-	-	-
2h	TTT4175	MARINE ACOUSTICS		7,5	-	-	-	-	-	v	v
		Master Thesis									
2v	TMR4930	MARINE TECHNOLOGY		30,0	o	o	o	o	o	o	o

o = compulsory course
v = optional course

Ex 1h = Term 1, Exam Autumn
Ex 1v = Term 2, Exam Spring
Ex 2h = Term 3, Exam Autumn
Ex 2v = Term 4, Master Thesis Spring

v1 - select one of the courses
v2 - compulsory course for students without equivalent background
v3 - select one of the two courses based on background

1) Courses should be selected so that the total weighting each term amounts to 30 credits (cr).
2) Supplementary courses are not considered when planning the teaching and examination schedules.

Specializations:
MS - Marine structures
MC - Marine cybernetics
MH - Marine hydrodynamics
ME - Marine engineering
MO - Marine operation and maintenance engineering
MD - Marine systems design
MR - Marine resources and aquaculture

FACULTY OF NATURAL SCIENCES AND TECHNOLOGY

MSC-PROGRAMME IN MEDICAL TECHNOLOGY (MSMEDTEK)

Term 1, 2, 3 and 4

No admittance 2014/15

Ex	Subject no.	Subject title	Note	Cr	Specialization 1	2	3	4
		Compulsory and optional courses						
1h	FY2302	BIOPHYSICS I		7,5	-	-	-	v
1h	IT3105	ART INTEL PROGR		7,5	-	v	-	-
1h	MFEL3010	MED FOR STUD OF NAT		7,5	o	o	o	o
1h	TDT4173	MACH LEAR/CASE REAS		7,5	-	v	v	-
1h	TDT4175	INFORM SYSTEMS	1	7,5	-	v	-	-
1h	TDT4200	PARALLEL COMPUTING	1	7,5	-	v	v	-
1h	TDT4210	HEALTHCARE INFORM		7,5	-	o	v	-
1h	TDT4237	SOFTWARE SECURITY		7,5	-	v	-	-
1h	TDT4245	COOPERATION TECHN		7,5	-	v	-	-
1h	TDT4250	MODEL DRIVEN DEV IS		7,5	-	v	-	-
1h	TDT4287	ALG FOR BIOINF		7,5	-	v	-	-
1h	TFY4225	NUCLEAR/RAD PHYS		7,5	-	-	-	o
1h	TFY4265	BIOPHYSICAL MICROMET		7,5	-	-	-	v
1h	TFY4310	MOLECULAR BIOPHYSICS		7,5	-	-	-	v
1h	TTK4160	MEDICAL IMAGING	1	7,5	o	v	v	-
1h	TTK4170	MOD/IDENT BIOL SYS		7,5	-	-	-	v
1h	TTT4130	DIGITAL COMMUN	1	7,5	v	v	-	-
1h	TTT4135	MULTIMEDIA SIGNAL PRO		7,5	v	-	-	-
1h	TTT4175	MARINE ACOUSTICS		7,5	v	-	-	-
1v	-	EXP IN TEAM INT PROJ		7,5	o	o	o	o
1v	DT8112	RES TOP HEALTH INFO		7,5	-	v	-	-
1v	MOL3019	APPL BIOINFORMATICS		7,5	-	-	o	-
1v	MOL4010	BASIC MOL BIOL	2	7,5	-	-	o	-
1v	TBT4165	SYST BIOL/BIOL NETW		7,5	-	-	v	-
1v	TDT4215	WEB INTELLIGENCE		7,5	-	v	-	-
1v	TDT4230	GRAPH/VISUAL		7,5	-	v	-	-
1v	TDT4240	SOFTWARE ARCHITECT		7,5	-	v	-	-
1v	TDT4242	REQUIREMENTS/TESTING		7,5	-	v	-	-
1v	TFY4280	SIGNAL PROCESSING		7,5	-	-	-	o
1v	TFY4315	BIOPHYS IONIZ RADIAT		7,5	-	-	-	o
1v	TFY4320	PHYS MED IMAG		7,5	v	-	v	o
1v	TMA4300	COMP STAT METHODS		7,5	-	-	v	-
1v	TTK4165	SIGNAL PROC MED IMAG		7,5	o	-	-	-
1v	TTT4125	INFO THEORY COD/COMP		7,5	o	-	-	-
1v	TTT4240	STAT SIGNAL THEORY		7,5	v	-	-	-

cont.

FACULTY OF NATURAL SCIENCES AND TECHNOLOGY

MSC-PROGRAMME IN MEDICAL TECHNOLOGY (MSMEDTEK)

Ex	Subject no.	Subject title	Note	Cr	Specialization			
					1	2	3	4
2h	DT8119	CLIN DEC SUPPORT		7,5	-	v	-	-
2h	IT3105	ART INTEL PROGR		7,5	-	v	-	-
2h	TDT4173	MACH LEAR/CASE REAS		7,5	-	v	-	-
2h	TDT4200	PARALLEL COMPUTING		7,5	-	v	-	-
2h	TDT4237	SOFTWARE SECURITY		7,5	-	v	-	-
2h	TDT4287	ALGORITHMS BIOINFO		7,5	-	v	o	-
2h	TKT4150	BIOMECHANICS		7,5	-	-	-	v
2h	TTK4160	MEDICAL IMAGING		7,5	-	v	-	v
2h	TTT4130	DIGITAL COMMUN		7,5	-	v	-	-
2h	TTT4135	MULTIMEDIA SIGNAL PRO		7,5	o	-	-	-
		Specialization courses	3					
2h	TDT4535	BIOINFORMATICS SC		7,5	-	-	o	-
2h	TDT4545	HEALTHCARE INFO SC		7,5	-	o	-	-
2h	TFY4505	BIOPHYSICS SC		7,5	-	-	-	o
2h	TTK4555	ENG CYBERNETICS SC	4	7,5	v	-	-	-
2h	TTT4525	SIGNAL PROC SC	4	7,5	v	-	-	-
		Specialization projects						
2h	TDT4530	BIOINFORMATICS SP		15,0	-	-	o	-
2h	TDT4540	HEALTHCARE INFO SP		15,0	-	o	-	-
2h	TFY4500	BIOPHYSICS SP		15,0	-	-	-	o
2h	TTK4550	ENG CYBERNETICS SP	4	15,0	v	-	-	-
2h	TTT4520	SIGNAL PROC SP	4	15,0	v	-	-	-
		Master Thesis						
2v	TDT4900	COMPUTER SCIENCE		30,0	-	o	o	-
2v	TFY4910	BIOPHYSICS		30,0	-	-	-	o
2v	TTK4900	ENGINEERING CYBERN	4	30,0	v	-	-	-
2v	TTT4900	SIGN PROC/COM	4	30,0	v	-	-	-

o = compulsory courses
v - optional courses

Ex 1h = Term 1, Exam Autumn
Ex 1v = Term 2, Exam Spring
Ex 2h = Term 3, Exam Autumn
Ex 2v = Term 4, Master Thesis Spring

Specialization:
1 Medical Signal Processing and Imaging
2 Healthcare Informatics
3 Bioinformatics
4 Biophysics and Medical Physics

1) The courses are not considered when planning the teaching and examination schedules (for specialization 2).
2) Lectures are held in Norwegian, but PBL exercises and presentations are given in english.
3) Other relevant ordinary subjects may be chosen, if taught in english.
4) Students at specialization Medical Signal Processing and Imaging should choose one of the combinations TTK4550/ TTK4555/TTK4900 or TTT4520/TTT4525/TTT4900.

FACULTY OF ENGINEERING SCIENCE AND TECHNOLOGY

MSC-PROGRAMME IN NATURAL GAS TECHNOLOGY (MSGASTECH)

Term 1, 2, 3 and 4

Ex	Subject no.	Subject title	Note	Cr
		Compulsory courses		
1h	TEP4185	NATURAL GAS TECHN		7,5
1h	TPG4140	NATURAL GAS		7,5
1v	-	EXP IN TEAM INT PROJ		7,5
		Optional courses	1	
1h	TEP4135	ENG FLUID MECH 1		7,5
1h	TEP4156	VISC FLOW/BOUND LAYER		7,5
1h	TEP4165	COMP HEAT/FLUID FLOW		7,5
1h	TEP4180	EXP METH PROC ENG		7,5
1h	TEP4240	SYSTEM SIMULATION		7,5
1h	TKP4170	PROCESS DESIGN PROJ		7,5
1h	TPK4120	SAFETY/RELIABILITY	2	7,5
1v	TEP4170	HEAT/COMBUST TECH		7,5
1v	TEP4195	TURBO MACHINERY		7,5
1v	TEP4215	ENERG UTIL/PROC INT		7,5
1v	TEP4250	MULTIPHASE TRANSPORT		7,5
1v	TEP4255	HEAT PUMP PROC SYST	2	7,5
1v	TKP4150	PETROCH/OIL REFINING		7,5
1v	TMT4285	HYDROGEN TECHN	2	7,5
1v	TPG4135	PROC OF PETR		7,5
1v	TPG4200	SUBSEA PRODUCT SYST	2	7,5
1v	TPG4230	FIELD DEVELOPMENT	2	7,5
1v	TPG5110	PETROLEUM ECONOMICS	2	7,5
		Specialization courses	3	
2h	TEP4515	THERMAL ENERGY SC		7,5
2h	TEP4525	INDUS PROC ENG SC		7,5
2h	TEP4545	ENG FLUID MECH SC		7,5
		Specialization projects	4	
2h	TEP4510	THERMAL ENERGY SP		15,0
2h	TEP4520	INDUS PROC ENG SP		15,0
2h	TEP4540	ENG FLUID MECH SP		15,0
		Supplementary courses	5	
2h	TEP4135	ENG FLUID MECH		7,5
2h	TEP4165	COMP HEAT/FLUID FLOW		7,5
2h	TEP4180	EXP METH PROC ENG		7,5
2h	TEP4240	SYSTEM SIMULATION		7,5
2h	TKP4170	PROCESS DESIGN PROJ		7,5
2h	TPK4120	SAFETY RELIABILITY		7,5
		Master Thesis	6	
2v	TEP4905	INDUS PROC ENG		30,0
2v	TEP4915	THERMAL ENERGY		30,0
2v	TEP4925	ENG FLUID MECH		30,0

Ex 1h = Term 1, Exam Autumn
Ex 1v = Term 2, Exam Spring
Ex 2h = Term 3, Exam Autumn
Ex 2v = Term 4, Master Thesis Spring

1) Optional courses must be selected to obtain a total of 30 credits in each semester.
2) The course is not considered when planning the teaching and examination schedules.
3) One specialization course must be chosen.
4) One specialization project must be chosen according to the selected specialization course.
5) Supplementary courses must be selected to obtain a total of 30 credits per semester. The courses are not considered when planning the teaching and examination schedules.
6) The master thesis must be chosen according to the selected specialization.

FACULTY OF ENGINEERING SCIENCE AND TECHNOLOGY

MSC-PROGRAMME IN PETROLEUM ENGINEERING (MSG1)

Term 1, 2, 3 and 4

Ex	Subject no.	Subject title	Note	Cr	Specialization 1	2	3
		Compulsory and optional courses	1				
1h	POL2022	PETR MANAGEM	2	7,5	v	v	v
1h	TPG4117	UNCONVENT RESERVOIRS		7,5	v	-	-
1h	TPG4145	RESERVOIR FLUIDS		7,5	o	v	o
1h	TPG4150	RESERVOIR REC TECHN		7,5	o	o	o
1h	TPG4151	SUBSUR DECIS ANALYS	2	7,5	v	v	v
1h	TPG4162	3D VISUAL PETR DATA	2	7,5	v	v	v
1h	TPG4175	PETROPHYSICS FUND		7,5	v	v	v
1h	TPG4177	CARB RESERVOIR CHAR		7,5	v	v	v
1h	TPG4215	HIGH DEV DRILLING		7,5	v	o	v
1h	TPG4235	WELL TESTING AC		7,5	v	v	v
1h	TPG5100	MATH/COMPUTER METHOD		7,5	o	o	o
1h	TPG5140	SPEC SUB SURF MAN	2	7,5	v	v	v
1v	-	EXP IN TEAM INT PROJ		7,5	o	o	o
1v	TPG4115	RES PROP DETERMIN		7,5	v	-	-
1v	TPG4160	RESERVOIR SIMULATION		7,5	o	v	v
1v	TPG4180	PETR PHYS INTERPR AC		7,5	v	v	v
1v	TPG4205	DRILL TECH PR CONTR		7,5	v	v	v
1v	TPG4220	DRILLING FLUID		7,5	v	o	v
1v	TPG4225	FRACTURED RESERVOIRS	2	7,5	v	-	-
1v	TPG4230	FIELD DEVELOPMENT		7,5	v	v	o
1v	TPG5110	PETROLEUM ECONOMICS	2	7,5	v	v	v
2h	TPG4140	NATURAL GAS		7,5	v	v	v
2h	TPG4177	CARB RESERVOIR CHAR		7,5	v	v	v
2h	TPG4185	FORMATION MECHANICS		7,5	v	v	v
2h	TPG4235	WELL TESTING AC		7,5	v	v	v
2h	TPG4250	ELECTROM METH OIL EX		7,5	v	v	v
2h	TPG4255	CO2 STORAGE	3	7,5	v	v	v
		Specialization courses					
2h	TPG4515	PETR PROD SC		7,5	-	-	o
2h	TPG4525	DRILLING ENG SC		7,5	-	o	-
2h	TPG4535	RESERVOIR ENG SC		7,5	o	-	-
		Specialization project					
2h	TPG4510	PETR PROD SP		15,0	-	-	o
2h	TPG4520	DRILLING ENG SP		15,0	-	o	-
2h	TPG4530	RESERVOIR ENG SP		15,0	o	-	-
		Master Thesis					
2v	TPG4920	PETROL ENGINEERING		30,0	o	o	o

o - compulsory courses
v - optional courses

Ex 1h = Term 1, Exam Autumn
Ex 1v = Term 2, Exam Spring
Ex 2h = Term 3, Exam Autumn
Ex 2v = Term 4, Master Thesis Spring

1) The courses must be selected to obtain a total of 30 credits in each semester. In addition to the subjects listed 2h students can choose from 1h Petroleum Engineering, 1h Petroleum Geosciences and PhD-courses.
2) The course is not considered when planning the teaching and examination schedules.
3) The course will not be taught in the academic year 2014/15.

Specialization:
1 Reservoir Engineering and Petrophysics
2 Drilling Engineering
3 Petroleum Production

FACULTY OF ENGINEERING SCIENCE AND TECHNOLOGY

MSC-PROGRAMME IN PETROLEUM GEOSCIENCES (MSG2)

Term 1, 2, 3 and 4

Ex	Subject no.	Subject title	Note	Cr	Specialization 1	Specialization 2
		Compulsory and optional courses	1			
1h	POL2022	PETR MANAGEM	2	7,5	v	v
1h	TGB4160	PETROLEUM GEOLOGY		7,5	v	o
1h	TGB4265	STRUCT GEOLOGY AC	2	7,5	v	v
1h	TPG4120	MIN ENG/ENV GEOPH	2	7,5	v	v
1h	TPG4125	SEISMIC WAVE PROP		7,5	o	o
1h	TPG4150	RESERVOIR REC TECHN		7,5	v	v
1h	TPG4162	3D VISUAL PETR DATA	2	7,5	v	v
1h	TPG4175	PETROPHYSICS BC		7,5	v	v
1h	TPG4177	CARB RESERVOIR CHAR		7,5	v	v
1h	TPG4185	FORMATION MECHANICS		7,5	v	v
1h	TPG4195	GRAVIMETR MAGNETOMET		7,5	v	v
1h	TPG4250	ELECTROM METH OIL EX	2	7,5	v	v
1h	TPG5100	APPL COMPUTER METHODS		7,5	o	o
1h	TPG5130	SEISMIC PROCESSING	2	7,5	v	v
1v	-	EXP IN TEAM INT PROJ		7,5	o	o
1v	TGB4135	BASIN ANALYSIS		7,5	v	v
1v	TGB4170	DIAGENESIS/RES QUAL		7,5	v	v
1v	TGB4275	GEOL RES MOD		7,5	v	v
1v	TPG4130	SEISMIC INTERPRET		7,5	o	o
1v	TPG4170	RESERVOIR SEISMICS		7,5	v	v
1v	TPG4180	PETR PHYS INTERPR AC		7,5	v	v
1v	TPG5110	PETROLEUM ECONOMICS	2	7,5	v	v
2h	TPG4151	SUBSUR DECIS ANALYS		7,5	-	v
2h	TPG4177	CARB RESERVOIR CHAR		7,5	-	v
2h	TPG4190	SEISMIC DATA		7,5	o	v
2h	TPG4255	CO2 STORAGE	3	7,5	-	v
		Specialization courses				
2h	TGB4565	PETR GEOLOGY SC		7,5	-	o
2h	TPG4545	PETR GEOPHYS SC		7,5	o	-
		Specialization project				
2h	TGB4560	PETR GEOLOGY SP		15,0	-	o
2h	TPG4540	PETR GEOPHYS SP		15,0	o	-
		Master Thesis				
2v	TGB4915	PETROLEUM GEOSCIENCE		30,0	-	o
2v	TPG4925	PETROLEUM GEOSCIENCE		30,0	o	-

o - compulsory courses
v - optional courses

Ex 1h = Term 1, Exam Autumn
Ex 1v = Term 2, Exam Spring
Ex 2h = Term 3, Exam Autumn
Ex 2v = Term 4, Master Thesis Spring

1) The courses must be selected to obtain a total of 30 credits in each semester. In addition to the subject listed 2h (TPG4190) students in specialization 2 can choose from 1h Petroleum Engineering, 1h Petroleum Geosciences and PhD-courses.
2) The course is not considered when planning the teaching and examination schedules.
3) The course will not be taught in the academic year 2014/15.

Specialization:
1 Petroleum Geophysics
2 Petroleum Geology

FACULTY OF SOCIAL SCIENCES AND TECHNOLOGY MANAGEMENT

MSC-PROGRAMME IN PROJECT MANAGEMENT (MSPROMAN)

Term 1, 2, 3 and 4

Ex	Subject no.	Subject title	Note	Cr	Specialization		
					1	2	3
		Compulsory courses	1				
1h	TBA5200	PROJ PLAN/ANALYSIS		7,5	o	o	o
1h	TIØ5200	PROJ ORG		7,5	o	o	o
1h	TPK5100	PROJ PLAN/CONTR		7,5	o	o	o
1v	-	EXP IN TEAM INT PROJ		7,5	o	o	o
1v	TIØ5210	PROGRAM MGMT		7,5	o	o	o
1v	TIØ5215	GLOB GOV OF SUPPLY		7,5	o	o	o
		Optional courses	1				
1h	TBA4315	ECONOM/TRANSP INFRA		7,5	v	-	-
1h	TIØ4265	STRATEGIC MANAGEMENT		7,5	-	v	-
1h	TPK5160	RISK ANALYSIS		7,5	-	-	v
1v	TGB5110	ENG GEO/TUNNEL BC		7,5	v	-	-
1v	TIØ4175	PURCH LOG MGMT		7,5	-	v	-
1v	TPK4110	QUAL/PERFORMANCE		7,5	-	-	v
		Compulsory and optional courses	2				
2h	TPK5115	RISK MANAGEM PROJ		7,5	v	-	v
2h	TIØ4345	MAN BUS RELAT/NETW		7,5	-	v	-
		Specialization courses					
2h	TBA4128	PRO MAN AC		7,5	o	-	-
2h	TIØ5225	PRO MAN SC		7,5	-	o	-
2h	TPK4420	PROJECT FLEXIBILITY		7,5	-	-	o
		Specialization projects					
2h	TBA4530	PRO MAN SP		15,0	o	-	-
2h	TIØ5230	PRO MAN SP		15,0	-	o	-
2h	TPK4520	PRO/QUAL MAN SP		15,0	-	-	o
		Master Thesis					
2v	TBA4910	PROJ MANAGEMENT		30,0	o	-	-
2v	TIØ4920	PROJ MANAGEMENT		30,0	-	o	-
2v	TPK4920	PROJ/QUAL MANAGEMENT		30,0	-	-	o

o - compulsory courses
v - optional courses

Ex 1h = Term 1, Exam Autumn
Ex 1v = Term 2, Exam Spring
Ex 2h = Term 3, Exam Autumn
Ex 2v = Term 4, Master Thesis Spring

1) In addition to the compulsory courses, the student must select 15 cr relevant for their technological specialization. Optional courses listed are recommended, but students may substitute other courses from the same department with Faculty permission.
2) In the second year, the student will choose a specialization project, specialization course and master thesis corresponding to the technological specialization chosen in the first year. In addition, they need an extra course in 3rd semester. Recommended courses are shown in the table, but students may substitute other courses from the same department with Faculty permission.

Specialization:
1. Civil Engineering
2. Industrial Engineering
3. Production and Quality Engineering

FACULTY OF ENGINEERING SCIENCE AND TECHNOLOGY

MSC-PROGRAMME IN RELIABILITY, AVAILABILITY, MAINTAINABILITY AND SAFETY (MSRAMS)

Term 1, 2, 3 and 4

Ex	Subject no.	Subject title	Note	Cr
		Compulsory courses		
1h	TPK4120	SAFETY/RELIABILITY		7,5
1h	TPK4140	MAIN MANAGEMENT		7,5
1h	TPK5115	RISK MANAGEM PROJ		7,5
1h	TPK5160	RISK ANALYSIS		7,5
1v	-	EXP IN TEAM INT PROJ		7,5
1v	TIØ4205	SHE-METH/TOOLS SHE	1	7,5
1v	TMA4255	APPLIED STATISTICS	1	7,5
1v	TMA4275	LIFETIME ANALYSIS	1	7,5
1v	TPG4200	SUBSEA PRODUCT SYST	1	7,5
1v	TPK5165	RAMS ENG/MANAGEMENT		7,5
2h	FI5205	CORP RESPONS ETHICS	2	7,5
2h	SPRÅK3501	SCIENTIFIC COM	2	7,5
2h	TEP4223	LIFE CYCLE ASSESSMENT	2	7,5
2h	TIØ4201	RISK GOVERNANCE	2	7,5
2h	TPK4550	RAMS SP		15,0
2h	TPK5170	RAMS OPTIMISATION		7,5
		Master Thesis		
2v	TPK4950	RAMS		30,0

Ex 1h = Term 1, Exam Autumn
Ex 1v = Term 2, Exam Spring
Ex 2h = Term 3, Exam Autumn
Ex 2v = Term 4, Master Thesis Spring

1) Select two of the courses.
2) Select one of the courses.

FACULTY OF ENGINEERING SCIENCE AND TECHNOLOGY

MSC-PROGRAMME IN SUSTAINABLE ENERGY (MSSE)

Term 1, 2, 3 and 4

Ex	Subject no.	Subject title	Note	Cr
		Compulsory courses		
1h	TEP4165	COMP HEAT/FLUID FLOW		7,5
1h	TEP4185	NATURAL GAS TECHN		7,5
1v	-	EXP IN TEAM INT PROJ		7,5
1v	TEP4130	HEAT MASS TRANSFER		7,5
1v	TEP4255	HEAT PUMP PROC SYST		7,5
		Optional courses		
1h	TEP4180	EXP METH PROC ENG	1	7,5
1h	TEP4212	GAS CLEAN/EMISSION	2	7,5
1h	TEP4223	LIFE CYCLE ASSESSM	2	7,5
1h	TEP4235	ENERGY MANAG BUILD	2	7,5
1h	TEP4240	SYSTEM SIMULATION	1	7,5
1v	TEP4220	ENERGY/ENV CONSEQUEN	3	7,5
1v	TEP4260	HEAT PUMP BUILDINGS	3	7,5
1v	TEP4265	THERMAL PROCESS FOOD	3	7,5
		Specialization		
2h	KULT2207	GENDER/NORW CULTURE	4,5	7,5
2h	TEP4180	EXP METH PROC ENG	4	7,5
2h	TEP4223	LIFE CYCLE ASSESM	4	7,5
2h	TEP4520	INDUS PROC ENG SP		15,0
2h	TEP4525	INDUS PROC ENG SC		7,5
		Master Thesis		
2v	TEP4905	INDUS PROC ENG		30,0

Ex 1h = Term 1, Exam Autumn
Ex 1v = Term 2, Exam Spring
Ex 2h = Term 3, Exam Autumn
Ex 2v = Term 4, Master Thesis Spring

1) Select one of the courses.
2) Select one of the courses.
3) Select one of the courses.
4) Select one of the courses.
5) This course is compulsory for students from Shanghai Jiao Tong University.

FACULTY OF INFORMATION TECHNOLOGY, MATHEMATICS AND ELECTRICAL ENGINEERING

MSC-PROGRAMME IN TELEMATICS - COMMUNICATION NETWORKS AND NETWORKED SERVICES (MSTCNNS)

Term 1, 2, 3 and 4

Ex	Subject no.	Subject title	Note	Cr	Specialization 1	2	3
		Compulsory courses					
1h	TTM4105	ACCESS TRANS NETW		7,5	o	o	o
1h	TTM4110	DEP AND PER WITH SIM		7,5	o	o	o
1h	TTM4150	INTERNET NETW ARCH		7,5	o	o	o
1v	-	EXP IN TEAM INT PROJ		7,5	o	o	o
1v	TTM4115	ENG DIST REAL SYS		7,5	o	o	o
1v	TTM4135	INFORMATION SEC		7,5	o	o	o
		Optional courses	1				
1h	TDT4175	INFO SYST		7,5	v	v	v
1h	TDT4237	SOFTWARE SECURITY		7,5	v	v	v
1v	TTM4128	NETW AND SERV MAN		7,5	v	v	v
1v	TTM4133	MOB NETW/SERVICE		7,5	v	v	v
		Specialization courses					
2h	TTM4516	NETWORKS/QUALITY SC		7,5	o	-	-
2h	TTM4526	SERV AND SYST ENG SC		7,5	-	o	-
2h	TTM4536	INFO SECURITY SC		7,5	-	-	o
		Specialization projects					
2h	TTM4511	NETWORKS/QUALITY SP		15,0	o	-	-
2h	TTM4521	SERV AND SYST ENG SP		15,0	-	o	-
2h	TTM4531	INFO SECURITY SP		15,0	-	-	o
2h	TTM4137	WIRELESS SECURITY		7,5	-	-	o
2h	TTM4158	DEP AND PERF DESIGN		7,5	o	-	-
2h	TTM4160	SOFTWARE DESIGN		7,5	-	o	-
		Master Thesis					
2v	TTM4905	NETWORKS/SERVICES		30,0	o	o	o

o = compulsory courses
v = optional courses

Ex 1h = Term 1, Exam Autumn
Ex 1v = Term 2, Exam Spring
Ex 2h = Term 3, Exam Autumn
Ex 2v = Term 4, Master Thesis Spring

1) Select one of the courses each semester.

Specialization:
1 Networks and Quality of Service
2 Services and Systems Engineering
3 Information Security

NORDIC MASTER IN DANCE STUDIES (NO-MA-DS)

Learning outcomes

Knowledge

Master graduates in dance studies

- have specialised knowledge about application and development of dance studies.
- have knowledge about theory and methods in the fields such as analysis, history, anthropology and theory of dance.
- have knowledge about the central and the most actual research topics in the field.

Skills

- Master graduates in dance studies
- can use the knowledge and methods to implement analytical projects on a high level.
- can use knowledge to develop an in-depth project in a particular field of dance.
- can run independent projects based on research.

General competences

Master graduates in dance studies

- can approach phenomena from different perspectives.
- can present or perform arguments in oral and written form using an appropriate terminology.
- can develop ideas and formulate problems in the field of studies; can collect, use and present subject matter, give advice and make professional evaluations.

Admission requirements

The programme is open to both international and Norwegian students. Admittance to the programme requires a bachelor's degree in dance studies or another relevant discipline combined with good background in dance, or other equivalent education. Possible admission to the programme of study requires a minimum of an average grade of C or the equivalent. C is however, not a guarantee for admission.

Course overview

Codes	Course	Credits	Semester	Restricted admission
DANS3003	Dance Analysis	15	Autumn	Yes 1)
DANS3002	Individual project	7,5	Autumn and Spring	Yes 1)
DANS3004	Individual project	15	Autumn and Spring	Yes 1)
DANS3005	Field and Archiving Techniques	15	Autumn	Yes 1)
DANS3010	Master Thesis	30	Autumn and Spring	Yes 2)
DANS6016	Phenomenology in Performance	15	Spring	
1) Requires admission to Nordic Master in Dance Studies or Erasmus mundus master program *Choreomundus* – International master in Dance Knowledge, Practice and Heritage 2) Requires admission to Nordic Master in Dance Studies				

Table of Structure

Below follows an overview of the structure of the Nordic master in Dance Studies:

Semester	7,5 ECTS Credits	7,5 ECTS Credits	7,5 ECTS Credits	7,5 ECTS Credits
4th semester Spring	DANS3010 Master's Thesis in Dance Studies (NTNU)		Dance Anthropology (University of Tampere)	
3rd semester Autumn	DANS3010 Master's Thesis in Dance Studies (NTNU)		Dance History (University of Copenhagen)	
2nd semester Spring	Dance and Cultural Theory (University of Stockholm)		Elective course (NTNU or University of Stockholm)	Elective course (NTNU or University of Stockholm)
1st semester Autumn	DANS3003 Dance Analysis (NTNU intensive course early september)		Elective course (NTNU or University of Stockholm)	

Regulations of accreditation

When it comes to the accreditation of external training/education abroad, each case must be assessed individually. See general rules for equivalency. Application for transfer of Norwegian degrees is to be sent to the department. Application for recognition of foreign degrees is to be sent to the faculty. Those who are admitted to the Nordic Master's program

in Dance studies have the opportunity to fulfill these requirements until the submission of master's thesis as stated in the individual master agreement.

Development and structure

The master programme in dance studies includes four joint courses: *Dance analysis* taught at NTNU (15 ECTS), *Dance and cultural theory* taught at University of Stockholm (15 ECTS), *Dance history* taught at University of Copenhagen (15 ECTS) and *Dance anthropology* taught at University of Tampere (15 ECTS). The master thesis is 30 ECTS.

Additionally each partner university has to provide at least one freely chosen course of minimum 7,5 ECTS. These courses are first of all meant for university's own students, but are open to all students as well. These study plans are considered in the agreement among universities and automatically recognized as part of the master study.

NTNU suggest four courses to choose freely from. Aesthetic is provided under the codes FI2101 *Spesialemne I i filosofi* (15 ECTS) or FI2103 *Spesialemne III i filosofi* (7,5 ECTS). For more information, please, contact the Department of Philosophy, NTNU. Additionally, Department of Music provides DANS3002 *Individual project* (7,5 ECTS), DANS3004 *Individual project* (15 ECTS), DANS3005 *Field and Archiving Techniques* (15 ECTS) and DANS6016 *Phenomenology in performance* (15 ECTS).

University of Stockholm provides following free-chosen courses: TVARKI *Arkivuppgift* (7,5 ECTS), TVKIAN *Kulturelle Iscensättningar* (15 ECTS), TVFLPR *Fältarbete/praktik* (7,5 ECTS).

University of Copenhagen provides following free-chosen courses: *Studieelement 307 – Det frie emne II* (15 ECTS), *Studieelement 308 – Det frie emne III* (7,5 ECTS), *Studieelement 309 – Det frie emne IV* (7,5 ECTS) and *Studielement 310 – Teknikk II: Teknikk, improvisation, komposition og formidling* (15 ECTS)

It is possible to apply for recognition of other courses, if they are useful for the master's thesis.

ERASMUS MUNDUS MASTER IN DANCE KNOWLEDGE, PRACTICE AND HERITAGE (CHOREOMUNDUS): CURRICULUM FOR THE ACADEMIC YEAR 2014–2015

Learning outcomes

Choreomundus is a two-year full time programme taught over four semesters at the four partner universities: Norwegian University of Science and Technology (NTNU), Blaise Pascal University (UBP), Scientific University of Szeged (SZTE), and University of Roehampton (URL). Students who successfully complete the programme gain 120 ECTS (European Credit Transfer System). They will be awarded a Joint Master's degree carrying the Erasmus Mundus label with diploma supplement. Every successful participant graduates simultaneously from the four European universities of the Choreomundus consortium.

During the course of study, students are introduced to theoretical, epistemological and methodological issues concerning the concept of Dance Heritage, with a focus on ethnographic material. This includes examples from the Nordic countries, from Eastern and Western Europe, from South Asia, Africa and Aboriginal Australia. Further examples will be provided by visiting scholars. The programme is committed to both movement and contextual analyses and has been designed to provide all students with a common scientific training to equip them with the intellectual tools necessary to analyse dance cross-culturally and to deal with dance as Intangible Cultural Heritage in diverse professional contexts. Fieldwork is an important feature, and brief field trips are undertaken in all four countries to allow students to engage fully with a number of european cultures. Moreover, an intensive period of fieldwork during the summer between the first and the second year, in a country of the student's choice is a prelude to the dissertation/thesis and a prerequisite to the successful completion of the Master's degree.

Knowledge

Master graduates in Choreomundus

- have specialised knowledge about development of dance studies.
- have knowledge about theory and methods in the fields such as analysis, anthropology and theory of dance.
- have knowledge about the central and the most actual research topics in the field.
- have in-depth knowledge about Intangible Cultural Heritage.

Skills

Master graduates in Choreomundus

- can use the knowledge and various methods to analyse dance on a high level.
- can run independent fieldwork projects and do corresponding research.
- can read and write dances notated in advanced Labanotation.

General competences

Master graduates in Choreomundus

- can approach phenomena from different perspectives.
- can present or perform arguments in oral and written form using an appropriate terminology.
- can develop ideas and formulate problems in the field of studies; can collect, use and present subject matter, give advice and make professional evaluations.

Admission requirements

Applications are invited from individuals who have:

- A first degree (equivalent to 180 ECTS) from a recognised higher education institution (university, college, conservatoire) preferably in dance studies, anthropology, folklore, heritage studies or in related subjects (drama and/or theatre, music, sports and human movement studies, sociology, cultural studies) or equivalent professional experience.
- English Language qualification equivalent to the International English Language Testing Sy
- stem (IELTS) Level 6.5 in each band (Listening, Reading, Writing and Speaking).
- Two letters of recommendation supporting their application.
- Expertise in or understanding of dance or related movement practices (rituals, games, martial arts and physical theatre) which can be demonstrated through one or more of the following:

  1) A DVD or online film/video clip of no more than three minutes duration, showing their own dancing, choreography or other relevant performances or productions, or their teaching

  2) An essay of no more than three pages long, focusing either on the contextual and/or movement aspects of a dance or other related practice

  3) A relevant publication.

Programme map and mobility of students

Year 1- Semesters 1 & 2:

Students spend their first year of study either at NTNU Trondheim (Group A) or at UBP Clermont-Ferrand (Group B). They are divided between the two universities according to the desired supervision focus for their master's dissertation/thesis. This will be more practically oriented with a focus on dance practice and movement analysis at NTNU or more theoretically oriented with a focus on contextual analysis at UBP. All students will, however, be trained in both perspectives through the two first year intensive courses (see below Programme content), one held in each of the two universities.

Year 1 – Semester 2:

In the beginning of the second semester students will have chosen the topic for their dissertation/thesis. They will undertake the necessary fieldwork during the period at the end of semester 2 and beginning of semester 3.

Year 2 – Semester 3:

In the second academic year, all students go to SZTE Szeged for their third semester of the study. The focus here will be on the documentation and archiving of dance and other movement structures, with further training in movement analysis. Students will begin analysing their fieldwork data for their dissertation.

Year 2 – Semester 4:

For the fourth and final semester of the programme, students will go to URL London. Courses will focus on anthropological analyses of dance in the contemporary context of post-colonialism, globalisation, transnationalism, and multiculturalism. Students will finalise the process of writing up their dissertation, which they shall submit by the end of July.

Development and structure: Semester Breakdown

Below follows a semester breakdown of the structure of the Choreomundus Master's Programme for both study tracks:

Study option/Study track: Ethnochoreology:

Semester	**30 ECTS Credits per semester**
4th semester Spring: ***Roehampton*** ***(joint courses across the two study tracks)***	· ***The Performance of Heritage: Dance in Museums, Galleries and Historic Sites*** **(10 ECTS)** · ***Extended Essay*** **(Dissertation 3) (10 ECTS)** · **One of following elective courses:** o ***Dance in Culturally Diverse Societies*** **(10 ECTS)** o ***Boundaries of the Body: Ritual, Dance and Performance*** **(10 ECTS)**
3rd semester Autumn: ***Szeged*** ***(joint courses across the two study tracks)***	· ***Dance Heritage, Individual Creativity*** **(5 ECTS)** · ***From Field to Archive*** **(5 ECTS)** · ***Research Methods*** **(Dissertation 2) (10 ECTS)** · **10 ECTS elective courses *)**
2nd semester Spring ***Blaise Pascal and NTNU***	· ***Critical Perspectives on Intangible Cultural Heritage*** **(Intensiv Programme 2 at UBP) (15 ECTS)** · DANS3006 *Dance as Knowledge* (5 ECTS) · DANS3007 *Analysing Dance – Dissertation 1* (10 ECTS)
1st semester Autumn ***NTNU***	· **DANS3003** ***Dance Analysis*** **(Intensive Programme 1 at NTNU) (15 ECTS)** · DANS3005 *Field and archiving techniques* (15 ECTS)
*) A list of courses will be announced prior to the beginning of the semester.	
Joint courses across the two study tracks are in bold.	

Study option/Study track: Anthropology:

Semester	**30 ECTS Credits per semester**
4th semester Spring: ***Roehampton*** ***(joint courses across the two study tracks)***	· ***The Performance of Heritage: Dance in Museums, Galleries and Historic Sites*** **(10 ECTS)** · ***Extended Essay (Dissertation 3)*** **(10 ECTS)** · **One of following elective courses:** o ***Dance in Culturally Diverse Societies*** **(10 ECTS)** o ***Boundaries of the Body: Ritual, Dance and Performance*** **(10 ECTS)**
3rd semester Autumn: ***Szeged*** ***(joint courses across the two study tracks)***	· ***Dance Heritage, Individual Creativity*** **(5 ECTS)** · ***From Field to Archive*** **(5 ECTS)** · ***Research Methods*** **(Dissertation 2) (10 ECTS)** · **10 ECTS elective courses *)**

2nd semester Spring ***Blaise Pascal***	· ***Critical Perspectives on Intangible Cultural Heritage*** **(Intensive Programme 2 at UBP) (15 ECTS)** · *Transmitting Dance as Embodied Culture, Knowledge and Experience* (5 ECTS) · *Conceptual and Methodological Issues for Fieldwork (Dissertation 1)* (10 ECTS)
1st semester Autumn ***NTNU and Blaise Pascal***	· **DANS3003** ***Dance Analysis*** **(Intensive Programme 1 at NTNU) (15 ECTS)** · *Anthropological analyses of dance (10 ECTS)* · *Ethnographic research methods: Fieldwork, interview and other techniques (5 ECTS)*
*) A list of courses will be announced prior to the beginning of the semester.	
Joint courses across the two study tracks are in bold.	

More information

More information is available on the web page of the programme: www.choreomundus.org

MASTER OF PHILOSOPHY (M.PHIL.) IN ENGLISH LINGUISTICS AND LANGUAGE ACQUISITION

The department offers an international Master's programme: Master of Philosophy (abbreviated 'M. Phil.') in English Linguistics and Language Acquisition.

Learning Outcome

This programme provides the basis for a career in public and private sector organisations where there is a demand for a high level of competence in the fields of English language and linguistics, language acquisition, or language and cognition, for example, expertise in how humans comprehend and use language in speech and writing.

The programme also provides the basis for further postgraduate education / doctoral research with a specialisation in language acquisition, language processing and/or English linguistics; or any career where analysis, development, text production and communication play an essential role.

Knowledge

The candidates

- are familiar with theoretical concepts and frameworks, and methods involved in the study of language acquisition, language and cognition, language processing and English linguistics,
- are acquainted with central questions and past and current debates in the subject area, and can compare, contrast and evaluate different approaches,
- have acquired in-depth specialist knowledge from the writing of their master's thesis on a self-chosen topic within the fields of language acquisition, language processing, language and cognition and/or English language and linguistics.

Skills

The candidates

- are able, using English, to apply an array of precise theoretical linguistic concepts in approaching and analysing a variety of different questions,
- are able to communicate in English, both orally and in writing, in formal and academic contexts using forms appropriate to the subject area,
- are able to identify relevant topics and questions within the subject area,
- know how to identify and locate source materials within the subject area, and are able to make critical use of these.

General competence

The candidates

- are able to formulate productive research questions and to assess the suitability and validity of different methodologies,
- are able to plan and carry out a research project of substantial scope under supervision,
- are able to make use of a range of research tools in a research investigation,
- know how to apply ethical standards in research, for example standards concerning the use and citation of sources and the handling of data that has been collected,
- are able to work with, to create an overview of, and to identify the main points in, large amounts of text,

- are able to create and organise an extensive written document in accordance with specific guidelines and requirements.

Admission/Entry requirements

The programme is open to Quota Programme applicants and to applicants with other sources of financing. Applicants should hold a B.A. or an equivalent degree in English or Linguistics with a sufficient background in topics related to English language or linguistics. Only candidates with a minimum of 20 ECTS in English language/linguistics courses will be considered for acceptance.

Successful applicants to the Master's programme must meet the minimum average grade requirement for admission, which is the grade C by the Norwegian grading scale, or equivalent approved minimum grade.

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

An English proficiency test must be included. Applicants must pass either the TOEFL with a minimum score of 600/90 points on the paper based/internet based test, or the IELTS with a minimum score of band 6.5. Citizens of Ireland, the UK, the US, Canada, Australia and New Zealand do not have to submit TOEFL/IELTS test results. This is also the case for applicants who have spent at least one year in any of these countries, attending higher secondary school or university. Applicants from African countries with a B.A./B.Sc./B.Eng. degree where the language of instruction has been English and those who have passed English as a subject at GCE A-level with grade C or better are also exempted. Applicants with a university degree in English language (B.A. in English) are also exempted from the English language proficiency test requirement. Please be aware that applicants from Asian countries (for example Bangladesh, India, Nepal, Pakistan, Sri Lanka, Thailand, and Vietnam) with a B.A./ B.Sc./ B.Eng. degree where the language of instruction has been English are not exempted from the English language requirements, except for candidates holding a B.A. degree in English.

Courses

Course code	Course title	ECTS credits	Semester	Restricted admission
ENG2153	First and Second Language Acquisition	7.5	Spring	
ENG2155	Theoretical Approaches to English Language	7.5	Autumn	
ENG3122	Cognitive and Theoretical Aspects of Language	15	Spring	
ENG3123	Translation	7.5	Spring	
ENG3510	Topics in Semantics	7.5	Autumn	
ENG3920	Master’s Thesis in English Linguistics and Language Acquisition	60	Autumn and spring	Yes 1)
SPRÅK3000	Theories and Methods in Linguistics	15	Autumn	
1) Admission to the course requires admission to the M. Phil.-programme.				

Programme components

The table below shows how a Master of Philosophy in English Linguistics and Language Acquisition is usually built up.

Semester	7.5 credits	7.5 credits	7.5 credits	7.5 credits
Spring 4	ENG3920 Master's Thesis in English Linguistics and Language Acquisition			
Autumn 3	ENG3920 Master's Thesis in English Linguistics and Language Acquisition			
Spring 2	ENG3122 Cognitive and Theoretical Aspects of Language		ENG3123 Translation	ENG2153 First and Second Language Acquisition
Autumn 1	SPRÅK3000 Theories and Methods in Linguistics		ENG3510 Topics in Semantics	ENG2155 Theoretical Approaches to English Language

The range of topics that could be offered in the programme includes advanced topics in modern English syntax, studies of the lexicon, first language acquisition and second language acquisition studies, translation theory and communication studies.

Students who wish to include other courses offered by the department, should contact the department for further information regarding the possibilities for an individual curriculum.

The department offers supervision in the syntax/semantics of modern English, first and second language acquisition, the syntax/semantics interface and theories on contemporary information structure.

In their second semester in the programme, students should choose a topic for their Master's thesis. A supervisor will be appointed for each student based on his or her choice of topic. By the end of the second semester, students have to submit a project proposal for their Master's thesis. The project proposal must be approved by the department.

After the first year of studies, during the period mid-June to mid-August, candidates are given the opportunity to go back to their home countries to do field-work if this is necessary for the completion of their thesis. Students who are supported by the Quota Programme are awarded an extra grant to cover field-trip expenses.

MASTER OF PHILOSOPHY (M. PHIL.) IN LINGUISTICS: THEORETICAL, DESCRIPTIVE AND DIGITAL APPROACHES

This master's programme no longer admits new students. The last intake was in the autumn semester 2013.

This degree is also known as the 'International M. Phil in Linguistics'.

Learning outcome

A candidate who has reached master's level is expected to have the following qualifications: knowledge, skills and a general understanding beyond the BA level in linguistics.

Knowledge:
The candidate

- has a general knowledge about the principles for structuring linguistic signs as seen from a phonological, morphosyntactic, semantic and pragmatic perspective.
- is expected to possess an in-depth knowledge of at least one of the disciplines above.

Skills:
The candidate

- should be able to articulate a problem complex, have an understanding of the subject's history, a methodology in order to analyse the complex and the analysis that has been carried out, as is the case with a master's thesis

General competence
The candidate

- is able to practice critical and independent thinking, and produce well-formed ideas.
- has a general insight into linguistic problems and an ability to operationalise these in empirical studies.
- is able to seek, assess and point out relevant information and present this information in a way that illustrates linguistic problems.
- is able to present and pass on linguistic data, problems and results based on linguistic investigations, both spoken and written.

Admission requirements

Applicants should hold a B.A. or equivalent degree in Linguistics or an equivalent degree with a sufficient emphasis on topics related to Linguistics. Only candidates with a minimum of three Linguistics courses will be considered.

Applicants to the Master's programme must meet the minimum average grade requirement for admission, which is the grade C by the Norwegian A–F grading scale, or equivalent approved minimum grade

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

An English proficiency test result must be included. Applicants must pass either the TOEFL with a minimum paper score of 550 (230 computer) or the IELTS with a mark of 6.0 or better. Citizens of

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

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

Course outline

The M.Phil. Programme requires two years of full-time study, and starts in the autumn term. The ECTS credits are divided between courses comprising of a total of 75 ECTS credits, and a thesis of 45 ECTS credits. 60 ECTS credits represent the normal workload for a full-time student for one academic year. LING2211, LING 3304 and LING3305 are compulsory courses. The other courses may include both intermediate courses (LING2xxx courses) and master's courses (LING3xxx courses) of the candidate's choice from the first table below, in addition to maximum one of the interdisciplinary topics listed in the second table below. At least 45 ECTS credits must have a course code LING3xxx (master's level). The courses are selected from those offered to regular students in Linguistics. It is expected that the second semester of the second year shall be devoted exclusively to work on the master's thesis.

Topics offered in the programme

The range of topics that may be offered represents a subset of the topics offered in the regular Bachelor's and Master's Programmes in Linguistics, namely:

Course code	**Course title**	**ECTS credits**	**Semester**	**Restricted admission**
LING2208	Digital methods for speech and text processing	15	Spring 1)	
LING2211	*Semantics and Syntax 5)*	*15*	*Autumn 2)*	
LING3000	Chosen Topic	7,5	Spring 1)	
LING3304	*Phonology 5)*	*7,5*	*Autumn 2)*	
LING3305	*Pragmatics 5)*	*7,5*	*Autumn 2)*	
LING3302	Master's Course in Syntax and Semantics	15	Autumn 3)	
LING3308	Master's Course in Phonology	7,5	Spring 1)	
LING3309	Master's Course in Pragmatics	7,5	Spring 1)	
LING3392	M. Phil. Thesis in Linguistics	45	Autumn and Spring	Yes 4)

1) This course will be taught for the last time in the 2015 spring semester.
2) This course was taught for the last time in the 2013 autumn semester.
3) This course will be taught for the last time in the 2015 autumn semester
4) LING3392: Requires admission to the programme of study Master of Philosophy in Linguistics.
5) Compulsory courses in the M. Phil in Linguistics.

Interdisciplinary topics

The following courses are approved in an M.Phil. in Linguistics. Maximum *one* of the following courses may be admitted in the degree. More information about the courses is to be found in the course descriptions in the respective curricula.

Course code	Course title	ECTS credits	Semester	Restricted admission
FON1131	Introduction to Phonetics	15	Autumn	
ENG2153	First and Second Language Acquisition	7,5	Spring	
ENG3122	Cognitive and Theoretical Aspects of Language	15	Spring	

M.Phil. in Linguistics:

The table below shows how an M. Phil. in Linguistics can be built up.

Semester	7,5 credits	7,5 credits	7,5 credits	7,5 credits
Spring 4	LING3392 M. Phil. Thesis			
Autumn 3	LING3392 M. Phil. Thesis		LING3302 Master's Course in Syntax and Semantics	
Spring 2	LING2208 Digital Methods for speech and text processing		LING3308 Master's Course in Phonology	and LING3309 Master's Course in Pragmatics
Autumn 1	LING2211 Semantics and Syntax		LING3304 Phonology	LING3305 Pragmatics

MASTER OF PHILOSOPHY IN CHILDHOOD STUDIES

Approved by the Board at NTNU 30.08.2005, with changes made by the Faculty of Social Sciences and Technology Management 09.01.2014.

INTRODUCTION

The Norwegian Centre for Child Research (NOSEB) offers an interdisciplinary, international master's programme in Childhood Studies. The degree is awarded by the Faculty of Social Sciences and Technology Management at NTNU and administered by NOSEB. The master's programme offers an advanced education in interdisciplinary social studies of children and childhood.

Aim of the programme

The programme aims at providing the student with:

- Knowledge and perspectives regarding contemporary debates in childhood studies.
- Knowledge on how childhoods and children's lives vary and are shaped by historical, social, cultural, political, economic and everyday life contexts.
- Knowledge on international and regional conventions on children's rights and how they might be used to improve children's well-being.
- Skills to carry out independent research on children's lives and on childhood as a social phenomenon.
- The skill of contributing to promoting children's views and perspectives in public services.

In addition, the programme aims at providing the student with the following general competencies:

- Practical training in various steps of planning and carrying out project work and research on children's lives in different settings and in a global context.
- Knowledge and experience of multicultural environments through being an active student in the programme.
- Academic communication skills (writing and verbal) and reflexivity in contexts in which several parties are involved.

Furthermore, a main focus of the programme is to generate knowledge about childhood, children's life-worlds, and the politics of childhood in changing societies. The programme will give a broad introduction to different theoretical and methodological perspectives and key concepts in contemporary social and historical research on children and childhood. The central issue is childhood and related themes such as generation, gender, class, identity and ethnicity, as these take form through varying processes like globalisation, institutionalisation, consumption and commercialisation.

The master's programme is theoretically and methodologically related to interdisciplinary social studies of childhood. A child perspective, including participatory approaches and conducting research with children, represents a main integrative approach. The UN Convention on the Rights of the Child (CRC) is discussed as a tool to promote children's well-being worldwide. Important topics are children as participants in play, education, child labour, community building, and the social, political and economic reproduction of society in general. CRC can be seen as part of globalisation processes, producing particular images of what it means to be a child. An important aim is to encourage comprehensive insights in and an understanding of how the globalised conditions under which children grow up affect "local" and

"national" childhoods in both the global North and the global South. The ways in which children themselves explore and experience their everyday lives and childhoods are also explored.

Employment opportunities

The MPhil in Childhood Studies qualifies for work related to research, teaching, supervision and consultancy in the fields of children, welfare and social development. The master's programme will be relevant for building a career related to children and childhood in different public sectors in governmental organisations. This may include policy and planning for children's living conditions in ministries and institutions which concern children, both locally and internationally. Another important area is non-governmental organisations (NGOs), such as Save the Children and the Red Cross.

ADMISSION REQUIREMENTS

The master's programme accepts students financed by the Quota Programme, Norwegian/Nordic students, as well as international students with individual funding. The total number of admitted students is 20-25 per year.

Admittance to the programme requires a bachelor's degree in the social sciences or humanities, or other equivalent education. The average grade of the degree must be at least C by the Norwegian grading system, or equivalent, as decided by NTNU. A background in childhood studies, social anthropology, geography, sociology or history is recommended.

The language of instruction is English, and applicants must document their English proficiency by achieving a passing grade from a Norwegian upper secondary school (videregående skole) or through a standardized test (TOEFL 600/90 paper-based/internet-based or IELTS with 6.5 or better). Applicants may document their English proficiency in other ways, and students from some countries may be exempted from documenting their competence in English as described above. For more information, please contact the Office of International Relations or consult the following website: www.ntnu.edu/studies/imp/admissions.

Outline of the MPhil in Childhood Studies

Semester	Course (7,5 cr)	Course (7,5 cr)	Course (7,5 cr)	Course (7,5 cr)
4th sem/spring	BARN3900 Master's Thesis (60 cr)			
3rd sem/autumn				
2nd sem/spring	BARN3102 Children's Rights (7,5 cr)	BARN3201 Methods and Ethics in Child and Childhood Research (7,5 cr)	Experts in Teamwork (7,5 cr)	BARN3400 Preparatory Course, Master's Thesis (7,5 cr)
1st sem/autumn	BARN3101 Social Studies of Children and Childhood (7,5 cr)	BARN3202 Methodological Perspectives on Child and Childhood Research (7,5 cr)	BARN3300 Children and Development in the Global South (7,5 cr)	Elective (7,5 cr)

The master's programme in Childhood Studies involves two years of full-time study. The normal workload for a full-time student for one academic year is 60 credits. Most of the courses during both years have minimum 80% compulsory attendance. The programme is structured around a combination of core courses (52.5 credits) and elective courses (7.5 credits), which provide a general introduction to theory and methodology, as well as giving stu-

dents the opportunity to specialize in particular topics. In addition, the programme includes a master's thesis (60 credits).

Core courses

Code	Title	Cr.	Term	Admis-sion	Co mp.	Pre.
BARN3101	Social Studies of Children and Childhood	7,5	Autumn	Open	X	X
BARN3102	Children's Rights	7,5	Spring	Open	X	X
BARN3201	Methods and Ethics in Child and Childhood Research	7,5	Spring	Open	X	X
BARN3202	Methodological Perspectives on Child and Childhood Research	7,5	Autumn	Open	X	X
BARN3300	Children and Development in the Global South	7,5	Autumn	Open	X	X
BARN3400*	Preparatory Course, Master's Thesis	7,5	Spring	Admis-sion to program-me	X	X
EiT	Experts in Teamwork	7,5	Spring	Restricted admission	X	X
BARN3900*	Master's Thesis	60	Autumn /Spring	Admis-sion to program-me	X	X

Compulsory: The subject's compulsory activity must be passed to sit the exam. You are advised to read the subject description for more information.

Prerequisite: Prerequisites must be satisfied to be able to enroll in this subject. You are advised to read the subject description for more information.

* Requires admission to MPhil in Childhood Studies. Exception: BARN3400 is open for exchange students from the MA Children, Youth and International Development, Brunel University.

Elective courses

Code	Title	Cr.	Term	Admis-sion	Co mp.	Pre.
GEOG3006*	Quantitative Methods	7,5	Spring	Open	X	X
GEOG3515*	Environment, Development and Changing Rural Livelihoods	7,5	Autumn	Open	X	X
GEOG3516*	Humanitarianism: Theory and Practice	7,5	Autumn	Open	X	
GEOG3522*	Migration and Development	7,5	Spring	Open	X	X
PED3520*	Democracy and Education: Perspectives in Educational Sociology	7,5	Autumn	Open	X	X
SANT3508*	Globalization Theory and Culture	7,5	Spring	Open	X	X

Compulsory: The subject's compulsory activity must be passed to sit the exam. You are advised to read the subject description for more information.

Prerequisite: Prerequisites must be satisfied to be able to enroll in this subject. You are advised to read the subject description for more information.

* For up-to-date information about which courses are running, please contact the Department of Geography (GEOG courses), the Department of Education (PED3520) and the Department of Social Anthropology (SANT3508).

Experts in Teamwork (EiT)

Experts in Teamwork will be taught as an intensive village in this master's programme.

Master's thesis agreement

All students must sign a master's thesis agreement that regulates the relationship between student and supervisor, among other things.

Social and academic arrangements for students

At the beginning of the first semester, a common ground between students and teachers will be established. Through social and academic arrangements everyone will have the opportunity to get to know one another. Both students and teachers are encouraged to share experiences from their own childhoods and/or childhoods in their "home country", and basic theoretical perspectives within Childhood Studies will be introduced and discussed.

PHD

MPhil in Childhood Studies qualifies for the PhD Programme in Interdisciplinary Child Research, as well as several other PhD Programmes within the social sciences.

COURSE DESCRIPTIONS

BARN3101 Social Studies of Children and Childhood

Teaching: Autumn: 7.5 Cr

Language of instruction: English

Credit reduction: BARN3100: 7.5 Cr, BARN3001: 7.5 Cr

Grade: Letter grade

Compulsory assignments: Attending lectures is compulsory (minimum 80%)

Recommended previous knowledge: See required previous knowledge.

Required previous knowledge: Admittance to the course requires a bachelor's degree in a social science or humanities discipline, or equivalent.

Learning objectives: This course aims to introduce students to theoretical perspectives, concepts and ongoing debates in social studies of children and childhood, as well as to how children's everyday lives and welfare and the politics of childhood vary across time and space.

By the end of the course participants will have gained knowledge and understanding of:

- The interdisciplinary social studies of children and childhood, the historical background, concepts and contemporary perspectives, and debates on and critique of the approach.

- Childhood as a social, cultural and historical phenomenon, children's everyday lives and well-being related to cultural and societal circumstances as well as politics of childhood in changing societies.

Academic content: Framed by social studies of children and childhood, the course addresses theoretical perspectives on child and childhood research as these have unfolded both historically and still today in contemporary societies. This includes, among others, the adoption of a developmental approach, as well as viewing childhood as socially constructed. The course addresses issues at a structural level, that have implications for children's everyday lives and

childhood, as well as children's active contribution and agency in defining and giving meaning to their lives, activities and relations. Central issues to explore in this course are images and understandings of children and childhood, generational relations, culture, gender, identity, ethnicity, children's lived experiences in relation to peer activities and adult organization, and their expectations in and outside educational institutions. The course also addresses childhood as a social phenomenon and shows how children are both shaped by and themselves shape their childhood experiences within diverse societal and daily life conditions, practices, power and generational relations.

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

Teaching methods and activities: Total lecture hours: ca. 20 hours.

Assessment: Written examination

Forms of assessment	Time	Percentage	Deadline
Written examination	4 Hours		

BARN3102 Children's Rights

Teaching: Spring: 7.5 Cr

Language of instruction: English

Credit reduction: BARN3100: 7.5 Cr

Grade: Letter grade

Compulsory assignments: Oral presentation. Attending lectures and seminar is compulsory (minimum 80%).

Recommended previous knowledge: It is an advantage to have read the UNCRC convention and being familiar with the legal language in the document.

Required previous knowledge: Admittance to the course requires a bachelor's degree in a social science or humanities discipline, or equivalent.

Learning objectives: The main objectives of the course are to provide students with knowledge of:

- Global discourses on the UN Convention on the Rights of the Child (CRC): theoretical debates and judicial principles.

- Regional conventions on children's rights (e.g. the African charter on the rights of the child).

- Rights discourses as a tool to improve children's life conditions and well-being in different parts of the world.

- The dynamic relationship between rights discourses as part of globalisation processes and children's lives in all parts of the world.

Academic content: The course provides students with an overview of different declarations on children's rights in a historical perspective. They learn how to discuss the UN Convention on the Rights of the Child and its implications for children's lives in different parts of the world. The students will learn to explore children's lives and welfare in light of changing policies and processes of globalization. The students acquire knowledge about the principle of the 'best interest of the child' and children's rights to provision, protection and participation. Among additional topics to be addressed are emerging issues on the rights of minority-group children (e.g. the rights of street children, the rights of refugee children etc.), children as social participants in the economic, social and cultural reproduction of society, the role of NGOs in the implementation of the UN Convention on the Rights of the Child, assessments of national reports on children's rights, migration and ethnicity, etc. Through nuanced discussion, the course also provides students with knowledge about the competing discourses on children

as autonomous beings or as dependent social becomings.

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

Teaching methods and activities: Total lecture hours: ca. 18 hours, total seminar hours: up to 12 hours. The course consists of: (1) a common introduction with lectures; (2) a seminar with presentation and discussion of the individual students' term papers. Each student will be required to comment on another student's term paper; (3) a seminar addressing practical work with children's rights in different parts of the world (invited speakers from Save the Children, Norad and/or others).

Assessment: Assignment

Forms of assessment	Time	Percentage	Deadline
Assignment			

BARN3201 Methods and Ethics in Child and Childhood Research

Teaching: Spring: 7.5 Cr

Language of instruction: English

Credit reduction: BARN3200: 7.5 Cr, BARN3002: 4.0 Cr

Grade: Letter grade

Compulsory assignments: Compulsory attendance in all the training workshop days. Attending lectures is also compulsory (minimum 80%).

Recommended previous knowledge: See required previous knowledge.

Required previous knowledge: Admittance to the course requires a bachelor's degree in a social science or humanities discipline, or equivalent.

Learning objectives:

- To familiarize students with a range of participatory, child-focused methods and ethics.

- To enable students design and carry out independent research with children and young people in diverse settings and contexts.

- To provide students with the opportunity to critically evaluate current scholarships on the social, moral, ethical and practical challenges of undertaking research with children and young people.

Academic content: The course focuses on research tools, techniques and ethics, rather than methodology. It takes its points of departure on the idea that children are social actors with agency, who create and use meanings and are subjects of human rights. It follows that they have the right to be properly researched, enabled to share their views and experiences through methods that are both scientific and ethical. The course is practical and experiential - students will practice how to design and use a variety of research methods that should be useful for data collection in their own MPhil research projects.

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

Teaching methods and activities: The course begins with an introductory lecture on perspectives and principles related to scientific and ethical research with children and young people. This is accompanied by a week-long training workshop that involves hands-on experience on engaging children and young people in different stages of the research process. The training workshop draws on a manual for child-focused, participatory approaches and gives students the opportunity to develop a repertoire of methods and ethical strategy by means of concrete examples, as well as plenary and group discussions. Additional lectures will be given by lecturers undertaking empirical studies with children in different parts of the world.

Students will have to write a term paper that is related to their master's thesis, carefully apply-

ing the reading list and knowledge they acquired from the course.

Assessment: Assignment

Forms of assessment	Time	Percentage	Deadline
Assignment			

BARN3202 Methodological Perspectives on Child and Childhood Research

Teaching: Autumn: 7.5 Cr

Language of instruction: English

Credit reduction: BARN3200: 7.5 Cr, BARN3002: 4.0 Cr

Grade: Letter grade

Compulsory assignments: Approved working paper and oral presentation. Attending lectures and seminar is compulsory (minimum 80%).

Recommended previous knowledge: See required previous knowledge.

Required previous knowledge: Admittance to the course requires a bachelor's degree in a social science or humanities discipline, or equivalent.

Learning objectives: The course aims to present theory that informs different methods and techniques in child and childhood research and develop students' ability to reflect critically on the relationship between the purpose of a study and the theoretical and the methodological choices that arise throughout a research process. The course also aims to offer students the possibility to write brief academic texts.

By the end of the course participants will have gained an understanding of:

- Theory of science: knowledge about different research paradigms, and theoretical perspectives related to empirical research on children and childhood as a social phenomenon and interpretive methodologies.

- Reflexivity: through empirical examples, student activities and discussions, to reflect upon the relationship between overall scientific principles, perspectives and debates, as well as on issues to consider when preparing a research plan.

- Academic writing: knowledge about expectations regarding an academic text through lectures, individual writing and group discussions.

Academic content: The course will provide an overview of different scientific paradigms and perspectives, focus specifically on ethnographic approaches and discuss how a focus on children as subjects in research influences the various steps in a research process, such as formulating a research question, preparing an empirical inquiry, obtaining access to the field, ethics, collecting data, analysis and interpretation of data, and drawing up a research text. This approach and content aim to develop students' reflexivity and qualify them to make informed decisions when planning an inquiry.

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

Teaching methods and activities: Total lecture hours: ca. 20 hours, total seminar hours: up to 12 hours, with presentation and discussion of individual students' working papers. The time allocated for seminars will be organized in 3-4 seminars during the semester, and each student will be required to comment on another student's working paper.

Assessment: Written examination

Forms of assessment	Time	Percentage	Deadline
Written examination	4 Hours		

BARN3300 Children and Development in the Global South

Teaching: Autumn: 7.5 Cr

Language of instruction: English

Grade: Letter grade

Compulsory assignments: Approved term paper. Attending lectures is compulsory (minimum 80%).

Recommended previous knowledge: See required previous knowledge.

Required previous knowledge: Admittance to the course requires a bachelor's degree in a social science or humanities discipline, or equivalent.

Learning objectives:

- To familiarize students with how children in diverse social, economic, cultural and political contexts of the global South fare in their lives.

- To provide students with an interdisciplinary understanding of the complex interrelationship between development processes and young people's everyday lives.

- To provide students with skills in critically evaluating current research and scholarship in the field of children and socio-economic and cultural change.

Academic content: The course provides opportunities for students to develop systematic knowledge on how young people are impacted by and respond to various development processes (e.g. national and global policies, structural adjustment programs, international trade and treaties). Specific topics covered include an overview of the interface between childhood studies and development studies; young people and socio-cultural change; the meanings and values of children; interventions for children in difficult circumstances (e.g. street children, refugee children); child labour/children's work; education for boys and girls; children, migration and social change; political economy of childhood poverty; impacts of HIV/AIDS on children; politics of orphanhood and care; children and armed conflicts; youth, participation and political activism.

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

Teaching methods and activities: Total lecture hours: ca. 20 hours. The course begins with a series of lectures that draws on a selected reading list. Students are required to write a term paper on a topic related to the content of the course. The term paper is not graded but it needs to be submitted and approved before students can qualify to sit for the final written examination.

Assessment: Written examination

Forms of assessment	Time	Percentage	Deadline
Written examination	4 Hours		

BARN3400 Preparatory Course, Master's Thesis

Teaching: Spring: 7.5 Cr

Language of instruction: English

Grade: Pass/Fail

Compulsory assignments: Attending seminar is compulsory (minimum 80%).

Recommended previous knowledge: See required previous knowledge.

Required previous knowledge: Admittance to the course requires a bachelor's degree in a social science or humanities discipline, or equivalent. The course is reserved for students admitted to MPhil in Childhood Studies, with one exception: Exchange students from the MA Children, Youth and International Development, Brunel University.

Learning objectives: To provide students with basic knowledge and skills to prepare and design scientific research projects. The students will develop a research design, including an empirical study, which will then form the basis for the master's thesis.

Academic content: The course will draw on BARN3201, and prepare the students for their work with the master's thesis. The various stages of the research process will be discussed, such as defining research questions, how to make use of acquired knowledge of theory and methodology, analysis etc. During the course the students will develop a master's project. Each student's project will be discussed in plenum. By the end of the course, a final project description must be submitted.

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

Teaching methods and activities: Total seminar hours: ca. 18 hours. Form of assessment: approved oral presentation and project description.

Assessment: Oral examination/Report

Forms of assessment	Time	Percentage	Deadline
Oral examination		1/2	
Approved report		1/2	

BARN3900 Master's Thesis

Teaching: 1st sem. autumn, 2nd sem. spring: 60.0 Cr

Language of instruction: English

Grade: Letter grade

Compulsory assignments: Empirical study, participation in Master's Thesis Seminar (minimum 80%), submission of chapter drafts, individual supervision.

Recommended previous knowledge: See required previous knowledge.

Required previous knowledge: Admittance to the course requires a bachelor's degree in a social science or humanities discipline, or equivalent. The course is reserved for students admitted to MPhil in Childhood Studies.

Learning objectives: To provide students with training in carrying out a scientific study related to children and childhood. The Master's Thesis Seminar in particular will focus on academic writing and present the expectations to an academic text.

Academic content: Students will select a topic for the master's thesis, which must be an autonomous, scientific study based on concrete research questions related to children and childhood. The thesis should be 80-120 pages (Times New Roman 12, space 1.5).

Normally, the thesis must include an empirical study. Data collection should be completed by the middle of the 3rd semester (medio October). The students are recommended to use the summer between the 2nd and 3rd semester for data collection.

The thesis is expected to be completed within four semesters from admission to the programme. Supervision will not be provided beyond this time.

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

Teaching methods and activities: The students will take part in a Master's Thesis Seminar series that puts emphasis on theoretical and practical issues related to the process of writing a master's thesis. All students are required to present and discuss their thesis project at the seminar. In addition, the students will be given individual supervision, and they are expected to hand in chapter drafts to their supervisor throughout the writing period. All students must sign a master's thesis agreement that regulates the relationship between student and supervisor, among other things. Forms of assessment: Master's thesis and oral exam. The final grade for

the thesis will be decided upon after the oral exam.

Assessment: Thesis

Forms of assessment	Time	Percentage	Deadline
Thesis			

GEOG3006 Quantitative Methods

Teaching: Spring: 7.5 Cr

Language of instruction: English

Credit reduction: GEOG3002: 7.5 Cr, GEOG3052: 7.5 Cr, GEOG3004: 7.5 Cr, AFR3002: 7.5 Cr, AFR3005: 7.5 Cr

Grade: Pass/Fail

Compulsory assignments: Seminar presentation, group assignment and individual assignments.

Recommended previous knowledge: See required previous knowledge.

Required previous knowledge: GEOG3003. Other relevant qualifications may be accepted by the Department of Geography.

Learning objectives: The course gives the students deeper insight in the use of questionnaires and application of selected quantitative methods. Students should be able to apply these methods and techniques, overview their possibilities and limitations and give an adequate interpretation of the (analytical) results in their master thesis.

Academic content: The course pursues methodologies into a quantitative array of research schemes. It comprises four parts. (1) The course starts with lectures on questionnaire, (2) followed by group work on construction and presentation of a pilot questionnaire. Part 3 comprises lectures and exercises based on the use of a statistical software package (SPSS) for analysis of data. The main focus will be on statistical analyses of available data (database), however entering questionnaire data with further analyses may be an option. A research design comprising correlation and regression will be presented, as will other analytical techniques based on the students' specific needs. In part 4, students will prepare an assignment in which they reflect on their choice of specific and appropriate methods and techniques directly related to their master thesis.

Teaching methods and activities: Lectures: 10 hours. Seminars: 10 hours. Exercises: 8 hours. It is expected that compulsories and examinations must be completed in English. Exceptions must be clarified with the lecturer responsible for the course.

Assessment: Oral examination

Forms of assessment	Time	Percentage	Deadline
Oral examination			

GEOG3515 Environment, Development and Changing Rural Livelihoods

Teaching: Autumn: 7.5 Cr

Language of instruction: English

Grade: Letter grade

Compulsory assignments: Groupwork and presentation

Required previous knowledge: Bachelor in social science. Other relevant qualifications can be accepted upon approval by the Department of Geography.

Learning objectives: After the course the students should have an in-depth understanding of

the links between development, environmental change and (rural) livelihood in African and Asian societies. Through the presentations the students should demonstrate ability to summarize and present findings from advanced research articles.

Academic content: Among the topics covered by the course:

- History of geographical thought: From environmental determinism to political ecology.
- Social nature; Social constructivism and environmental narratives.
- Institutions, norms and collective action and the idea of the "community" as basis for natural resource management.
- Hazards and vulnerability. Vulnerability; a useful concept or just another way of labelling?: Vulnerability analysis in practice
- Environmental conservation and development; from "Fortress conservation" to "Conservation and development"?
- Changing rural livelihoods and livelihood analysis; from farm to non-farm and implications for the rural environments.
- Environment and conflicts. The "Environment" as basis for conflicts.

Teaching methods and activities: Lectures: 14 hours. Groupwork and presentations (obligatory). It is expected that compulsories and examinations must be completed in English. Exceptions must be clarified with the lecturer responsible for the course.

Please note that the course may be cancelled due to the teaching capacity at the Department of Geography if less than 5 students register for the course. Check www.ntnu.no/geografi/studentinformasjon for updated information. The webpage will be updated 10th of January in the spring semester and 10th of August in the autumn semester.

Assessment: Written examination

Forms of assessment	Time	Percentage	Deadline
Written examination	4 Hours		

GEOG3516 Humanitarianism: Theory and Practice

Teaching: Autumn: 7.5 Cr

Language of instruction: English

Grade: Letter grade

Compulsory assignments: 2 assignments, compulsory attendance on the introduction day

Recommended previous knowledge: The course is given at master's level, a background equivalent to Bachelor in social sciences or extensive field experiences is therefore recommended.

Learning objectives: On completion students should be able to show a critical understanding of:

- The humanitarian system, its principles, actors, motivations and practices
- The outcomes of humanitarian crises for individuals and different groups of people
- The global governance of assistance in humanitarian emergencies
- How to develop an understanding of local contexts and local capacities in managing a humanitarian crisis
- The processes from relief to recovery during and after a humanitarian crisis
- The dilemmas between theory and practice

Academic content: Embedded in humanitarian action are a number of contentious issues regarding the relationships between political aims of donors and host governments and the

people concerned. The course will stress the relationship between theory and practice and how to deal with operational dilemmas on the ground. The lectures will introduce principles and theories of humanitarian action; the various actors involved; the relationship between them and their motivations; the emergence of humanitarian regimes; the relationship between political development and humanitarian practice; humanitarianism and forced migration; gender, ethnicity and humanitarian challenges; ethical dilemmas, aid conditionality and the Do No Harm and Relief to Development concepts. The lectures are internet based with one day compulsory introductory seminar. For the students present at NTNU some seminars relating to the internet based lectures will be held. Assignments are approved/not approved.

Teaching methods and activities: Internet based, 1-day compulsory introductory seminar, altogether equivalent to 16 hours lectures. There will be additional seminars for the students present at NTNU. It is expected that compulsories and examinations must be completed in English. Exceptions must be clarified with the lecturer responsible for the course.

Please note that the course may be cancelled due to the teaching capacity at the Department of Geography or if less than 5 students register for the course. Check www.ntnu.no/geografi/studentinformasjon for updated information. The webpage will be updated 10th of January in the spring semester and 10th of August in the autumn semester.

Assessment: Home examination

Forms of assessment	Time	Percentage	Deadline
Home examination			

GEOG3522 Migration and Development

Teaching: Spring: 7.5 Cr

Language of instruction: English

Grade: Letter grade

Compulsory assignments: Approved group work and seminar presentation

Required previous knowledge: Bachelor in social science. Other relevant qualifications can be accepted upon approval by the Department of Geography.

Learning objectives: On completion of this course students should be able to show a critical understanding of:

- National, regional and global patterns of migration with special reference to the Global South
- Causes, motivations and strategies for internal and international migration
- Theoretical perspectives on migration
- The relationships between different understandings and perspectives of migration and development
- Forced and voluntary migration and the relationships between them
- Ways and principles for studying migration and development
- Governance of migration
- Migration as a development strategy

Academic content: The course discusses internal and international migration processes in a development context. In particular the course concentrates on understanding the relationship between migration and development by offering theoretical insights into how to conceptualise migration and how development theories have understood the role of migration in development. The course aims to provide analytical approaches for understanding the migration process by introducing debates on causes, practices, migration regimes and policies, as well as

the development impacts of internal and international migration. Methodological approaches for researching migration and development will be introduced.

Teaching methods and activities: 16 hours lectures, 10 hours group work and presentation (depending on the number of students). Teaching methods include films, discussions and presentations. It is expected that compulsories and examinations must be completed in English. Exceptions must be clarified with the lecturer responsible for the course.

Assessment: Written examination

Forms of assessment	Time	Percentage	Deadline
Written examination	4 Hours		

PED3520 Democracy and Education: Perspectives in Educational Sociology

Teaching: Autumn: 7.5 Cr

Language of instruction: English

Grade: Letter grade

Compulsory assignments: Contribution in one seminar or compulsory written assignment (4-6 pages)

Required previous knowledge: A bachelor's degree in one of the social sciences or humanities.

Learning objectives: The course renders knowledge about and theoretical perspectives on:

- Theoretical insights into the relationship between pedagogic interactions and contextual conditions.
- Understanding of the relations between formal, informal and non-formal education.
- How pedagogic practices contribute to change in contextual conditions at a macro level.
- How pedagogic practices reproduce contextual conditions at a macro level.

Academic content: Social interactions in pedagogical practices will highlight the preferred contents, methods and organizational or institutional characteristics within pedagogic practices. Pedagogic practices in formal, informal and non-formal education will also be considered. Pedagogic practices are embedded in contextual conditions at a macro level of specific social, political, economic and cultural realities and trends. These macro conditions are in constant interplay with micro realities making change possible both on the micro as well as the macro levels. This change will be partly influenced by the degree of participation and marginalization occurring in pedagogical practices ranging from reproduction of dominant contents to conscientization and praxis fundamental to participative democracy.

Course materials: The required course reading material is on approximately 500 pages.

Teaching methods and activities: This is a self study course with four seminars during the semester. Compulsory activity: Contribution in one seminar or written assignment (4-6 pages). The written assignments limited to the extent of maximum 15 pages (Times New Roman 12pt., line spacing 1.5). The responsible course coordinator determines whether the subject of the assignment is a) optional or b) bound to a limited set of issues. Arrangements are made for an ongoing interaction between seminars and the student‘s development of the project topic. The topic, research question must be approved by the responsible course coordinator before 1st of November. Deadline for submission is 10th of December.

If less than 10 students sign up for the course it may be cancelled.

Assessment: Assignment

Forms of assessment	Time	Percentage	Deadline
Assignment			

SANT3508 Globalization Theory and Culture

Teaching: Spring: 7.5 Cr

Language of instruction: English

Credit reduction: SANT3507: 5.0 Cr

Grade: Letter grade

Compulsory assignments: Written assignment

Required previous knowledge: Either 60 ECTS in Social Anthropology or a bachelor's degree or equivalent.

Learning objectives: The candidate has attained

- a broad understanding of the key concepts of globalization theory
- knowledge of various theories of globalization processes
- insight into recent research pertaining to globalization processes

Skills:

The candidate has acquired skills to

- asses the implications of globalization for people's everyday life
- analyze the construction of meaning, identity and subjectivity in a globalized world
- analyze the construction of new social imaginaries and cultural repertoires in a globalized world

Academic content: Globalization is the buzzword of the 21st century. If we live in a globalized world, what does this mean for our economics, our culture, our work and leisure, even our sense of ourselves? The course offers a survey of the major theories and debates of globalization. The course examines in addition the social and cultural aspects of globalization processes.

Globalization processes refers to the intensification of global interconnectedness which entails increased standardization, homogenization and universalization as Western ideologies circulate more widely. Accommodating unifying and standardizing and universalizing impulses, however, we also find more heterogeneous, particular and local expressions, hybridization, creolization and forms of resistance. The deterritorialization of culture and the global flow of commodities, advertising and media give rise to new premises for the construction of meaning, identity and subjectivity, along with new social imaginaries and cultural repertoires.

Course materials: See reading list available at the beginning of the semester.

Teaching methods and activities: Lectures, seminars and written assignment.

Assessment: Written examination

Forms of assessment	Time	Percentage	Deadline
Written examination	4 Hours		

CREDIT ADJUSTMENTS DUE TO OVERLAP IN CONTENT

Course	Course	Credits
BARN3100	BARN3101	7,5 credits
BARN3100	BARN3102	7,5 credits
BARN3101	BARN3001	7,5 credits
BARN3200	BARN3201	7,5 credits
BARN3200	BARN3202	7,5 credits
BARN3201	BARN3002	4 credits

BARN3202	BARN3002	4 credits
GEOG3006	GEOG3002	7,5 credits
GEOG3006	GEOG3052	7,5 credits
GEOG3006	GEOG3004	7,5 credits
GEOG3006	AFR3002	7,5 credits
GEOG3006	AFR3005	7,5 credits
SANT3508	SANT3507	5 credits

MASTER OF PHILOSOPHY IN DEVELOPMENT STUDIES, SPECIALISING IN GEOGRAPHY

Approved by the Board at NTNU 16.12.2002, with changes made by the Faculty of Social Sciences and Technology Management 10.01.2014

INTRODUCTION

The Master in Development Studies, specialising in Geography, is a programme designed for students who want to specialise in development studies and social change. The degree is awarded by the Faculty of Social Sciences and Technology Management at NTNU and administered by the Department of Geography. It is an interdisciplinary degree that is relevant for students with backgrounds in different social sciences and development studies. The programme is relevant for a variety of jobs, including research, planning, resource management, and teaching. Through the MPhil programme in Development studies, specialising in geography, students should:

- Gain a thorough understanding of key concepts and theories within the field of development studies and geography
- Acquire robust/suitable methodological and analytical skills
- Be able to identify and formulate relevant and feasible research objectives for a scientific study
- Be able to carry out an independent research project by:
    - Identifying an appropriate research design, collecting and analysing data
    - Applying relevant theories and when analysing empirical data
    - Writing a scientific text and disseminating scientific knowledge
    - Complying with established ethical norms for research and dissemination.
    - Acquire skills relevant for employment in public and private sectors and in academic research.

The programme is open to both international and Norwegian students. The language of instruction is English for this study programme and we expect students to do all their compulsories and examinations in English. No exceptions will be made in this regard.

ADMISSION REQUIREMENTS

Admittance to this programme requires a Bachelor's degree in Social Sciences. The degree must include at least one year of studies within geography, planning or development studies.

The average grade of the degree must be at least C by the Norwegian grading system, or equivalent, as decided by NTNU.

The language of instruction is English. All lectures and seminars will be held in English, all reading material is in English and all term papers, assignments, exam papers and the thesis must be submitted in English.

The applicants must document their English proficiency by achieving one of the following:

A passing grade from a Norwegian upper secondary school (videregående skole), or through a standardized test:

- TOEFL (Test of English as a Foreign Language) with a minimum score of 600/90 paper based / internet based.

- IELTS (International English Language Testing Service) with a minimum score of 6.5 points

Exceptions from this requirement can be given for certain groups of applicants. For more information about the admission requirements, please consult the following webpage: http://www.ntnu.edu/studies/langcourses/languagerequirements.

COURSE OUTLINE

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

The core courses are: GEOG3053 Theories of Development and Globalization, Experts in Teamwork (EiT), GEOG3003 Methodology and the Research Process, GEOG3919 Fieldwork and either GEOG3005 Qualitative Methods or GEOG3006 Quantitative Methods.

Students can choose electives worth 30 credits from a number of courses offered by the Department of Geography or other departments. Most of the electives will be offered in the autumn term. Courses other than those listed below can be chosen as electives. Other courses may be chosen if approval is given by the Department of Geography.

CORE COURSES

Code	Title	Cr.	Term	Admission	Comp.	Pre.
EiT	Experts in Teamwork	7,5	Spring	Restricted admission	X	X
GEOG3003	Methodology and the Research Process	7,5	Autumn	Open	X	X
GEOG3005	Qualitative Methods	7,5	Spring/ Autumn	Open	X	X
GEOG3006	Quantitative Methods	7,5	Spring	Open	X	X
GEOG3053	Discources of Development and Globalization	7,5	Autumn	Open	X	X
GEOG3919*	Fieldwork	15	Spring/ Autumn	Restricted admission	X	X
GEOG3920*	Master's Thesis	45	Autumn /Spring	Restricted admission		

Compulsory: The subject's compulsory activity must be passed to sit the exam. You are advised to read the subject description for more information.

Prerequisite: Prerequisites must be satisfied to be able to enroll in this subject. You are advised to read the subject description for more information.

* Requires admission to the programme.

ELECTIVES

Code	Title	Cr.	Term	Admission	Comp.	Pre.
GEOG2009	Vector Based GIS	7,5	Spring	Open	X	X
GEOG3030	Natural Resources Management	7,5	Autumn	Open	X	X
GEOG3505	Landscape and Planning	15	Autumn	Open	X	X
GEOG3515	Environment, Development and Changing Rural Livelihoods	7,5	Autumn	Open	X	X
GEOG3516	Humanitarianism: Theory and Practice	7,5	Autumn	Open	X	
GEOG3518	Knowledge Management in a Global Economy	7,5	Autumn	Open	X	X
GEOG3522	Migration and Development	7,5	Spring	Open	X	X
GEOG3523	GIS Data Capture and Mapping	7,5	Spring	Open	X	X
AAR4234*	Urban Planning for Sustainability and Development	7,5	Spring	Open	X	X
BARN3300	Children and Development in the South	7,5	Autumn	Open	X	X
GEOG3524	Raster Based GIS	7,5	Autumn	Open	X	X

Compulsory: The subject's compulsory activity must be passed to sit the exam. You are advised to read the subject description for more information.

Prerequisite: Prerequisites must be satisfied to be able to enroll in this subject. You are advised to read the subject description for more information.

Elective courses may be cancelled due to the teaching capacity at the Department of Geography or if less than 5 students register for the course.

Check www.ntnu.no/geografi/studentinformasjon for updated information about what courses are available.

Information about cancellations will be given no later than January 10th in spring term and August 10th in autumn term. For courses available outside the department of Geography, please contact the respective department.

*Please note deadline for registration.

MPhil in Development Studies, specialising in Geography, programme structure:

Term	Course (7,5 cr)	Course (7,5 cr)	Course (7,5 cr)	Course (7,5 cr)
4. sem/Spring	GEOG3920			
3. sem/Autumn	GEOG3920		Electives (7,5 credits)	GEOG3919
2. sem/Spring	GEOG3005 or GEOG3006	Electives (7,5 credits)	EiT	GEOG3919
1.sem/Autumn	GEOG3053	GEOG3003	Electives (15 credits)	

Candidates are expected to collect data and conduct fieldwork for their thesis in the beginning of the third semester (2-3 months).

Experts in Teamwork (EIT)

The course is normally taught every Wednesday throughout the spring semester (regular village). It is not possible to take the course as an intensive village in this master's programme.

COURSE DESCRIPTIONS

AAR4234 Urban Planning for Sustainability and Development VK

Teaching: Spring: 7.5 Cr

Language of instruction: English

Grade: Letter grade

Compulsory assignments: Group-based case study on a current building project in Trondheim

Recommended previous knowledge: None, but the course will subsequently give priority to attend course AAR4525 Urban Ecological Planning in Developing Countries; Project Work, to AAR4820 Urban Ecological Planning. Theory, and to AAR4816 Urban Ecological Planning, Method.

Required previous knowledge: Completed three years basic courses in architecture, bachelor in architecture or equivalent. Registration deadline: 1. december..

Learning objectives: Knowledge: The course is to give insight into what "sustainability" and "development" entails for (urban) development and (urban) planning - in a national and a global perspective. The course will highlight how planning and implementation of physical interventions interact with its social and material context. Skills: The students will through the practical class project and discussions develop the ability to critically analyse the premises on which urban development takes place, the actors and processes that determine these premises and the consequences this has for both the immediate context of the project and overall urban development.

Academic content:

- Modes of Planning conducive of achieving sustainable urban development - in Norway and internationally
- Use and Management of Natural Resources; Water, Energy, Land
- Transport Land use
- Architecture’s contribution towards a sustainable future.
- Housing and settlement planning.
- Agents and institutions and their impact on modes of development

Course materials: A total of about 350 pages reading material related to the topics of the lectures.

Teaching methods and activities: The course is given in cooperation with several departments at the Faculty of Architecture and Fine Art, the Faculty of Engineering Science and Technology, and the Faculty of Social Science and Technology Management. Weight is placed on interdisciplinary seminars with introductory speakers from other faculties and from specialists with experience in development-related issues.

A case study on current urban development projects being planned and/or implemented in Trondheim to explore how the concepts of Development and Sustainability is actually practices in the North and how this might relate to, and bear impact on the overarching global development challenges.

Assessment: Written examination/Report

Forms of assessment	Time	Percentage	Deadline
Approved report		1/3	
Written examination	5 Hours	2/3	

BARN3300 Children and Development in the Global South

Teaching: Autumn: 7.5 Cr

Language of instruction: English

Grade: Letter grade

Compulsory assignments: Approved term paper. Attending lectures is compulsory (minimum 80%).

Recommended previous knowledge: See required previous knowledge.

Required previous knowledge: Admittance to the course requires a bachelor's degree in a social science or humanities discipline, or equivalent.

Learning objectives:

- To familiarize students with how children in diverse social, economic, cultural and political contexts of the global South fare in their lives.

- To provide students with an interdisciplinary understanding of the complex interrelationship between development processes and young people's everyday lives.

- To provide students with skills in critically evaluating current research and scholarship in the field of children and socio-economic and cultural change.

Academic content: The course provides opportunities for students to develop systematic knowledge on how young people are impacted by and respond to various development processes (e.g. national and global policies, structural adjustment programs, international trade and treaties). Specific topics covered include an overview of the interface between childhood studies and development studies; young people and socio-cultural change; the meanings and values of children; interventions for children in difficult circumstances (e.g. street children, refugee children); child labour/children's work; education for boys and girls; children, migration and social change; political economy of childhood poverty; impacts of HIV/AIDS on children; politics of orphanhood and care; children and armed conflicts; youth, participation and political activism.

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

Teaching methods and activities: Total lecture hours: ca. 20 hours. The course begins with a series of lectures that draws on a selected reading list. Students are required to write a term paper on a topic related to the content of the course. The term paper is not graded but it needs to be submitted and approved before students can qualify to sit for the final written examination.

Assessment: Written examination

Forms of assessment	Time	Percentage	Deadline
Written examination	4 Hours		

GEOG3003 Methodology and the Research Process

Teaching: Autumn: 7.5 Cr

Language of instruction: English

Credit reduction: GEOG3002: 7.5 Cr

Grade: Pass/Fail

Compulsory assignments: Field course preparations, presentation, field course with report

Required previous knowledge: Bachelor's degree in Social Sciences, Biology, Chemistry or Resource Geology or the equivalent. Other relevant qualifications can be accepted by the Department of Geography. The course is also open for students admitted to the 5-year teacher training programme in Geography.

Learning objectives: The course gives the students a deeper knowledge on stages of the research process and relations to the common methodologies in the subject. The students should develop relevant skills and experience through participation in a limited field work based on relevant methods and disseminate their research results.

Academic content: The course focuses on getting started in geographical research at master level. It is comprised of two main parts: (1) a lecture / seminar part, (2) a field course with additional preparations and seminars. Various methodologies are practiced during the field course, in which students work in groups on particular topics and research objectives. The group work will form part of a common field course report.

Emphasis is placed on developing a critical and reflexive attitude to the choice of research objective, research questions and the application of different methodologies. Some lectures will address the process with developing research objectives and choice of methodology for the master thesis. This process will end in a project assignment which delimits the theme, research objectives / questions and an assessment of researchdesign, appropriate methodology and broader methods in the planned master thesis.

Teaching methods and activities: Field course, lectures: 10 hours, seminars: 8 hours.

It is expected that compulsories and examinations must be completed in English. Exceptions must be clarified with the lecturer responsible for the course.

Assessment: Assignment

Forms of assessment	Time	Percentage	Deadline
Assignment			

GEOG3005 Qualitative Methods

Teaching: Both autumn and spring: 7.5 Cr

Language of instruction: English

Credit reduction: GEOG3002: 7.5 Cr, GEOG3052: 7.5 Cr, AFR3002: 7.5 Cr, AFR3005: 7.5 Cr, GEOG3004: 7.5 Cr

Grade: Pass/Fail

Compulsory assignments: Reflection notes/individual assignment

Recommended previous knowledge: See required previous knowledge.

Required previous knowledge: GEOG3003. Other relevant qualifications may be accepted by the Department of Geography. It is optional for those attending the 5-year teacher training programme in Geography (master).

Learning objectives: Knowledge: Obtain an advanced understanding of methodological principles, core concepts and techniques in qualitative Research.

Skills: Be able to discuss, apply and assess adequate qualitative methods in relations to a chosen Research design.

General competency: Be able to write an independent assignment focusing on research design or specific aspects of qualitative research.

Academic content: The course focuses on qualitative methodology, such as case study, ethnography, multi-sited methodology, feminist methodology, and discourse analysis. Major emphasis will be on positioning, representation, reflexivity, ethics, and interpretations. Through lectures and exercises skills about how to generate data, conduct analysis and write-up the material when adopting methods such as interviews, focus groups discussions, observation, and text and image analyses are taught. The students will be able to try method(s) that

they will adopt in their master thesis, and they will have to write an assignment in which they reflect upon their choice of methodology in their own master thesis.

Teaching methods and activities: Autumn semester: Reading course only.

Spring semester: 14 hours lectures, 6 hours exercises.

It is expected that compulsories and examinations must be completed in English. Exceptions must be clarified with the lecturer responsible for the course.

Assessment: Oral examination

Forms of assessment	Time	Percentage	Deadline
Oral examination			

GEOG3006 Quantitative Methods

Teaching: Spring: 7.5 Cr

Language of instruction: English

Credit reduction: GEOG3002: 7.5 Cr, GEOG3052: 7.5 Cr, GEOG3004: 7.5 Cr, AFR3002: 7.5 Cr, AFR3005: 7.5 Cr

Grade: Pass/Fail

Compulsory assignments: Seminar presentation, group assignment and individual assignments.

Recommended previous knowledge: See required previous knowledge.

Required previous knowledge: GEOG3003. Other relevant qualifications may be accepted by the Department of Geography.

Learning objectives: The course gives the students deeper insight in the use of questionnaires and application of selected quantitative methods. Students should be able to apply these methods and techniques, overview their possibilities and limitations and give an adequate interpretation of the (analytical) results in their master thesis.

Academic content: The course pursues methodologies into a quantitative array of research schemes. It comprises four parts. (1) The course starts with lectures on questionnaire, (2) followed by group work on construction and presentation of a pilot questionnaire. Part 3 comprises lectures and exercises based on the use of a statistical software package (SPSS) for analysis of data. The main focus will be on statistical analyses of available data (database), however entering questionnaire data with further analyses may be an option. A research design comprising correlation and regression will be presented, as will other analytical techniques based on the students specific needs. In part 4, students will prepare an assignment in which they reflect on their choice of specific and appropriate methods and techniques directly related to their master thesis.

Teaching methods and activities: Lectures: 10 hours. Seminars: 10 hours. Exercises: 8 hours. It is expected that compulsories and examinations must be completed in English. Exceptions must be clarified with the lecturer responsible for the course.

Assessment: Oral examination

Forms of assessment	Time	Percentage	Deadline
Oral examination			

GEOG3030 Natural Resources Management

Teaching: Autumn: 7.5 Cr

Language of instruction: English

Grade: Letter grade

Compulsory assignments: Field course- 3 days, approved field course report

Required previous knowledge: Bachelor's degree in Social Sciences, Biology, Chemistry or Resource Geology or the equivalent. Other relevant qualifications can be accepted by the Department of Geography

Learning objectives: The course aims to give students insight into questions of nature management through relating theory to practical management. Current management questions will be highlighted through lectures and fieldwork.

Academic content: The subject focuses on the challenges facing the management of natural resources, including matters such as dealing with different types of conflict, which require a combination of broad professional and practical insight. The course therefore addresses how different practical and professional perspectives can be combined to give increased insight in selected management challenges. The course will take as its starting point a number of management themes which will be illustrated using current theories together with examples of practical solutions. The course will be based on one contemporary Norwegian nature resource management conflict. The subject is interdisciplinary and the lectures are held by researchers as well as management representatives.

Teaching methods and activities: 18 hours lectures and an obligatory 3-day field course. The field course report must be approved before a student can take the exam.

It is expected that compulsories and examinations must be completed in English. Exceptions must be clarified with the lecturer responsible for the course.

Please note that the course may be cancelled due to the teaching capacity at the Department of Geography or if less than 5 students register for the course. Check www.ntnu.no/geografi/studentinformasjon for updated information.

Assessment: Written examination

Forms of assessment	Time	Percentage	Deadline
Written examination	4 Hours		

GEOG3053 Discources of Development and Globalization

Teaching: Autumn: 7.5 Cr

Language of instruction: English

Credit reduction: GEOG3050: 7.5 Cr, GEOG3504: 7.5 Cr, SVGEO350: 7.5 Cr

Grade: Letter grade

Compulsory assignments: Assignment

Required previous knowledge: Bachelor in social science. Other relevant qualifications can be accepted upon approval by the Department of Geography.

Learning objectives: Students shall broaden their knowledge of theories of social change through an introduction to different analytical perspectives in development theory and practice.

Academic content: GEOG3053 Discources of Development and Globalization is an introductory theory course, dealing with fundamental issues of development and globalization and how development and globalization are related. Different theories and key concepts will be introduced and examined with respect to development challenges of our times, such as poverty alleviation and growth, mobility, livelihoods, globalization and marginalization, rights, civil society. The course draws on a wide range of practical and empirical knowledge, as the lecturers represent different areas of specialization within the social sciences and many have cross-cultural experience.

Teaching methods and activities: Lectures, 20 hours and assignment.

It is expected that compulsories and examinations must be completed in English. Exceptions must be clarified with the lecturer responsible for the course.

Assessment: Written examination

Forms of assessment	Time	Percentage	Deadline
Written examination	4 Hours		

GEOG3505 Landscape and Planning

Teaching: Autumn: 15.0 Cr

Language of instruction: English

Credit reduction: SVGEO326: 7.5 Cr, SVGEO362: 7.5 Cr, SVGEO323: 7.5 Cr

Grade: Letter grade

Compulsory assignments: 1 day fieldcourse and approved term paper/project paper.

Recommended previous knowledge: See formal requirements.

Required previous knowledge: Bachelor in geography. Other relevant qualifications can be accepted upon approval by the Department of Geography

Learning objectives: The course gives insight into theoretical and methodological challenges related to landscape in connection with conservation, management and planning.

Academic content: The course discusses the concept of landscape, landscape values, and theoretical and methodological problems in landscape conservation, management and planning. It is offered as an elective course to students taking the Department of Geography's MA degree programmes, and is a compulsory course for students taking the Master degree in cultural heritage management.

Students taking the course as part of the M.Phil. in Development Studies and other foreign students are required to write an individual term paper based on the course literature with examples from their own country or another country with which they are familiar.

The term paper must be approved before the written exam can be taken.

Teaching methods and activities: 24 hours lectures, 16 hours seminars, one day field course, writing of term paper. It is expected that compulsories and examinations must be completed in English. Exceptions must be clarified with the lecturer responsible for the course.

Assessment: Written examination

Forms of assessment	Time	Percentage	Deadline
Written examination	6 Hours		

GEOG3506 Geography, Health and Development

Geography, Health and Development

Teaching: Autumn: 7.5 Cr

Language of instruction: English

Credit reduction: SVGEO331: 7.5 Cr

Grade: Letter grade

Compulsory assignments: Approved term paper.

Recommended previous knowledge: See formal requirements.

Required previous knowledge: GEOG1000-1006 or the equivalent or bachelor degree in social sciences.

Learning objectives: The course gives broad knowledge about health and related concepts within a geographical approach. Based on this body of knowledge and critical reflection the student should be able to carry out scientific work on selected geographical settings and communicate geography of health perspectives to others.

Academic content: The course focuses mainly on health status, disease/injury and risk factors, however the geography of health services at different levels is also discussed. The main emphasis is on health and diseases in developing countries.General trends in health and societal risk factors and environmental factors in different parts of the world are also covered. The course covers studies from quantitative and qualitative research traditions.

The course includes a presentation on health and medical literature in libraries and databases. Students' own reading will form the basis for writing a term paper, followed by an oral presentation at a seminar. The term paper must be approved before the written examination can be taken.

Teaching methods and activities: 16 hours lectures, 8 hours seminars.It is expected that compulsories and examinations must be completed in English. Exceptions must be clarified with the lecturer responsible for the course.

Please note that the course may be cancelled due to the teaching capacity at the Department of Geography or if less than 5 students register for the course. Check www.ntnu.no/geografi/studentinformasjon for updated information.

Assessment: Written examination

Forms of assessment	Time	Percentage	Deadline
Written examination	4 Hours		

GEOG3515 Environment, Development and Changing Rural Livelihoods

Teaching: Autumn: 7.5 Cr

Language of instruction: English

Grade: Letter grade

Compulsory assignments: Groupwork and presentation

Required previous knowledge: Bachelor in social science. Other relevant qualifications can be accepted upon approval by the Department of Geography.

Learning objectives: After the course the students should have an in- depth understanding of the links between development, environmental change and (rural) livelihood in African and Asian societies. Through the presentations the students should demonstrate ability to summarize and present findings from advanced research articles.

Academic content: Among the topics covered by the course:

- History of geographical thought: From environmental determinism to political ecology.
- Social nature; Social constructivism and environmental narratives.
- Institutions, norms and collective action and the idea of the "community" as basis for natural resource management.
- Hazards and vulnerability. Vulnerability; a useful concept or just another way of labelling?: Vulnerability analysis in practice
- Environmental conservation and development; from "Fortress conservation" to "Conservation and development"?
- Changing rural livelihoods and livelihood analysis; from farm to non-farm and implications for the rural environments.
- Environment and conflicts. The "Environment" as basis for conflicts.

Teaching methods and activities: Lectures: 14 hours. Groupwork and presentations (obligatory).

It is expected that compulsories and examinations must be completed in English. Exceptions must be clarified with the lecturer responsible for the course.

Please note that the course may be cancelled due to the teaching capacity at the Department of Geography if less than 5 students register for the course. Check www.ntnu.no/geografi/studentinformasjon for updated information. The webpage will be updated 10th of January in the spring semester and 10th of August in the autumn semester.

Assessment: Written examination

Forms of assessment	Time	Percentage	Deadline
Written examination	4 Hours		

GEOG3516 Humanitarianism: Theory and Practice

Teaching: Autumn: 7.5 Cr

Language of instruction: English

Grade: Letter grade

Compulsory assignments: 2 assignments, compulsory attendance on the introduction day

Recommended previous knowledge: The course is given at master's level, a background equivalent to Bachelor in social sciences or extensive field experiences is therefore recommended.

Learning objectives: On completion students should be able to show a critical understanding of:

- The humanitarian system, its principles, actors, motivations and practices
- The outcomes of humanitarian crises for individuals and different groups of people
- The global governance of assistance in humanitarian emergencies
- How to develop an understanding of local contexts and local capacities in managing a humanitarian crisis
- The processes from relief to recovery during and after a humanitarian crisis
- The dilemmas between theory and practice

Academic content: Embedded in humanitarian action are a number of contentious issues regarding the relationships between political aims of donors and host governments and the people concerned. The course will stress the relationship between theory and practice and how to deal with operational dilemmas on the ground. The lectures will introduce principles and theories of humanitarian action; the various actors involved; the relationship between them and their motivations; the emergence of humanitarian regimes; the relationship between political development and humanitarian practice; humanitarianism and forced migration; gender, ethnicity and humanitarian challenges; ethical dilemmas, aid conditionality and the Do No Harm and Relief to Development concepts. The lectures are internet based with one day compulsory introductory seminar. For the students present at NTNU some seminars relating to the internet based lectures will be held. Assignments are approved/not approved.

Teaching methods and activities: Internet based, 1-day compulsory introductory seminar, altogether equivalent to 16 hours lectires. Altogether equivalent to 16 hours lectures. There will be, additional seminars for the students present at NTNU. It is expected that compulsories and examinations must be completed in English. Exceptions must be clarified with the lecturer responsible for the course.

Please note that the course may be cancelled due to the teaching capacity at the Department of Geography or if less than 5 students register for the course. Check www.ntnu.no/geografi/studentinformasjon for updated information. The webpage will be updated 10th of January in the spring semester and 10th of August in the autumn semester.

Assessment: Home examination

Forms of assessment	Time	Percentage	Deadline
Home examination			

GEOG3518 Knowledge Management in a Global Economy

Knowledge Management in a Global Economy

Teaching: Autumn: 7.5 Cr

Language of instruction: English

Grade: Letter grade

Compulsory assignments: Semester assignment.

Required previous knowledge: Bachelor in social science. Other relevant qualification can be accepted upon by approval by the Department of Geography. Students with no background in social sciences are recommended to read an introductory book

Learning objectives: The students shall gain theoretical knowledge about economic, political and cultural aspects of industrial globalization. The central aim is to provide a comprehensive insight into the relations between processes of globalization and company strategies. The course provides skills in academic writing on these topics.

Academic content: The course offers different perspectives on globalization, together with discussions on how this influences actions and strategies of entreprises and national states. Focus is particularly on business practices in a globalized knowledge economy. Case examples illustrate how businesses can draw on their surroundings and networks locally, regionally, nationally and internationally in their endeavours to innovate. The course presents how strategies and actions occur at the interface between economy, politics and culture. Knowledge development across cultural boundaries is thus a central theme. As part of the course the students have to write an individual semester assignment. The semester assignment must be approved before the examination can be taken.

Teaching methods and activities: 18 hours lectures and assignment. The compulsory assignment and the exam must be completed in English. Exceptions must be clarified with the lecturer responsible for the course.

Please note that the course may be cancelled due to the teaching capacity at the Department of Geography or if less than 5 students register for the course. Check www.ntnu.no/geografi/studentinformasjon for updated information. The webpage will be updated 10th of January in the spring semester and 10th of August in the autumn semester.

Assessment: Written examination

Forms of assessment	Time	Percentage	Deadline
Written examination	4 Hours		

GEOG3522 Migration and Development

Teaching: Spring: 7.5 Cr

Language of instruction: English

Grade: Letter grade

Compulsory assignments: Approved group work and seminar presentation

Required previous knowledge: Bachelor in social science. Other relevant qualifications can be accepted upon approval by the Department of Geography.

Learning objectives: On completion of this course students should be able to show a critical understanding of:

- National, regional and global patterns of migration with special reference to the Global South
- Causes, motivations and strategies for internal and international migration
- Theoretical perspectives on migration
- The relationships between different understandings and perspectives of migration and development
- Forced and voluntary migration and the relationships between them
- Ways and principles for studying migration and development
- Governance of migration
- Migration as a development strategy

Academic content: The course discusses internal and international migration processes in a development context. In particular the course concentrates on understanding the relationship between migration and development by offering theoretical insights into how to conceptualise migration and how development theories have understood the role of migration in development. The course aims to provide analytical approaches for understanding the migration process by introducing debates on causes, practices, migration regimes and policies, as well as the development impacts of internal and international migration. Methodological approaches for researching migration and development will be introduced.

Teaching methods and activities: 16 hours lectures, 10 hours group work and presentation (depending on the number of students). Teaching methods include films, discussions and presentations.

It is expected that compulsories and examinations must be completed in English. Exceptions must be clarified with the lecturer responsible for the course.

Assessment: Written examination

Forms of assessment	Time	Percentage	Deadline
Written examination	4 Hours		

GEOG3523 GIS Data Capture and Mapping

Teaching: Spring: 7.5 Cr

Language of instruction: English

Grade: Letter grade

Compulsory assignments: Term paper

Recommended previous knowledge: GEOG1004.

Required previous knowledge: Completed Bachelor Degree and GEOG3519 Geographical Information Systems I or GEOG2009 Vector Based GIS. Equivalent courses must be approved by the Department of Geography.

Learning objectives: The course will teach students map making in Geographical Information systems (GIS), starting with data digitization through the production of digital and hard copy maps. There will be emphasis on data modeling and GIS database design, data capture in the field and through the use of remote sensing data. Processing of various types of data (digital elevation models, remote sensing data, aerial photographs, and field observations) for alignment in a GIS is an important topic. Basic cartography will also be covered. By

the end of the course the students should independently be able to produce maps containing social- or physical science data.

Academic content: This methodology course covers digital map production from data capture to finished web-GIS or hardcopy. The students will get an understanding of the whole map production work flow, including database design, data capture using remote sensing data and field based GIS digitization. Catographic output as web-GIS and hardcopy map will also be covered. The students will complete a mapping project (portfolio), and final map products will be part of the grading assessment together wih final written exam.

Course materials: Articles and technical reports will be announced in the beginning of the semester.

Teaching methods and activities: Master in Geography students writing a master‘s thesis in physical geography and/or using GIS in their thesis, can choose GEOG3523 as a compulsory methodology course.

16 hours lectures, 16 hours practical exercise work. Both

the written exam and the portfolio must be handed in and graded to E or better. It is expected that portfolio hand-ins and examinations must be completed in English. Exceptions must be clarified with the lecturer responsible for the course.

Assessment: Assignment/Written examination

Forms of assessment	Time	Percentage	Deadline
Assignment		2/5	
Written examination	3 Hours	3/5	

GEOG3524 Raster Based GIS

Teaching: Autumn: 7.5 Cr

Language of instruction: English

Credit reduction: SVGEO328: 3.0 Cr, GEOG3510: 3.0 Cr, GEOG3520: 7.5 Cr

Grade: Letter grade

Compulsory assignments: Semester assignment

Required previous knowledge: GEOG2009 Vector Based GIS or GEOG3519 Geographical Information System I, or equivalent.

Learning objectives:

Knowledge: Advanced knowledge about 3D surface representation and modeling in GIS.

Skills: Advance 3D modeling using geoprocessing software and scripting.

General competence: Student will gain competence usful for work within public management, private enterprises and research.

Academic content: 3D modeling of statistical surfaces and terrain surfaces. TIN and raster representations, raster processing (map algebra) and geoprocessing using model builder and scripting software. During the semester students will carry out several exercises. Results from these exercises will influence the final grade for this course.

Teaching methods and activities: 14 hours lectures, 16 hours practical exercise work. Both exam must be handed in and graded E or better.

It is expected that compulsories and examinations must be completed in English. Exceptions must be clarified with the lecturer responsible for the course. Please note that the course may be cancelled due to the teaching capacity at the Department of Geography or if less that 5 students register for the course. Check www.ntnu.no/geografi/studentinformasjon for updated

information. The webpage will be updated 10th of January in the spring semester and 10th of August in the autumn semester.

Assessment: Assignment/Written examination

Forms of assessment	Time	Percentage	Deadline
Assignment		2/5	
Written examination	3 Hours	3/5	

GEOG3919 Fieldwork

Teaching: 1st sem. spring, 2nd sem. autumn: 15.0 Cr

Language of instruction: English

Grade: Pass/Fail

Compulsory assignments: Two seminars, one before fieldwork and one after fieldwork is completed, as well as progress meetings.

Required previous knowledge: This course is reserved for students admitted to the MPhil in Development Studies.

Learning objectives: To prepare students for thesis data collection.

Academic content: Through seminars and fieldwork this course seeks to give students a chance to prepare themselves appropriately for the data collection for their thesis work, conduct fieldwork and report on their methodological and empirical achievements for their thesis work.

Course materials: Individual readings.

Teaching methods and activities: Seminars (20 hours), fieldwork (10 weeks), monthly progress meetings.

Assessment: Lectures

Forms of assessment	Time	Percentage	Deadline
Participated			

GEOG3920 Master‘s Thesis in Development Studies, specialising in Geography

Teaching: 1st sem. autumn, 2nd sem. spring: 45.0 Cr

Language of instruction: English

Grade: Letter grade

Compulsory assignments: None

Learning objectives: The aim of the course is to give the students training in doing a substantial individual research project, comprising of methodological and analytical training.

Academic content: The thesis consists of a scientific presentation of a chosen topic. The thesis should be 90 - 100 pages (Times Roman 12/ spacing 1.5/ approximately 40000 words). Students must prepare a project proposal as a part of the course GEOG3003. Supervisor will be assigned on the basis of this project proposal. The supervisor and MPhil coordinator must be kept informed about the progress of the writing. Candidates are expected collect data and conduct fieldwork for their thesis in the beginning of the third semester (2-3 months). The thesis is expected to be completed within four terms from admission to the course. Supervision will not be given beyond this. The thesis must be written individually and in English.

Teaching methods and activities: It is expected that compulsories and examinations must be completed in English. Exceptions must be clarified with the lecturer responsible for the course.

Exam: Thesis and oral. The oral exam is used to adjust the grade given for the thesis.

Assessment: Master's thesis

Forms of assessment	Time	Percentage	Deadline
Assignment			

CREDIT REDUCTIONS DUE TO OVERLAP IN CONTENT

Course	Course	Credits
GEOG3053	GEOG3050	7,5 credits
GEOG3054	GEOG3050	7,5 credits
GEOG3050	GEOG3504	7,5 credits
GEOG3053	GEOG3050	7,5 credits
GEOG3053	SVGEO350	7,5 creidts
GEOG3053	GEOG3504	7,5 credits
GEOG3003	GEOG3002	7,5 credits
GEOG3005	GEOG3052	7,5 credits
GEOG3005	AFR3005	7,5 credits
GEOG3005	AFR3002	7,5 credits
GEOG3005	GEOG3004	7,5 credits
GEOG3005	GEOG3002	7,5 credits
GEOG3006	GEOG3002	7,5 credits
GEOG3006	GEOG3052	7,5 credits
GEOG3006	GEOG3004	7,5 credits
GEOG3006	AFR3002	7,5 credits
GEOG3006	AFR3005	7,5 credits
GEOG3510	GEOG3519	6 credits
GEOG3510	GEOG3520	3 credits
GEOG3510	SVGEO328	6 credits
POL3503	POL8503	10 credits
GEOG3510	GEOG3521	6 credits
GEOG3519	GEOG2009	7,5 credits
GEOG3520	SVGEO328	3 credits

MASTER OF SCIENCE IN GLOBALIZATION, POLITICS AND CULTURE

Approved by the Board at NTNU 12.10.2006, with changes made by the Faculty of Social Sciences and Technology Management 13.1.2014.

A description of the Master's programme in Globalization

- The aim of the programme is to provide students with a general understanding of the forms and impacts of the processes of globalization related to politics and culture.

Learning objectives

- Through the master's programme the candidate:

Knowledge

- has advanced knowledge within the field of globalization studies and specialist knowledge within a given area (e.g. development and globalization, production management, knowledge management, economic restructuring).
- has thorought knowledge about the major theories and methods in globalization research, and hence can apply his/her knowledge on new scientific areas/fields as well as in real life situations.
- has obtained knowledge through work in real life situations through the internship and real work project.

Specific skills

- can work independently with theoretical and practical problem solving.
- can apply relevant and appropriate methods for research and other knowledge production in an independent manner.
- can analyze and critically relate to different sources and types of information and to apply these to structure and formulating academic argument.
- can conduct a limited research project independently, but under supervision and in accordance with existing ethical norms and guidelines.

General competency

- has command over the particular discourse and analytical concepts of the globalization research field.
- can apply his/her knowledge and skills to new research areas to implement advanced work tasks and projects.
- can disseminate substantial independent work.
- can contribute to creative and innovative thinking.
- has gained work experience, which is relevant for International organizations and companies.

Study environment

Students will enjoy an interdisiplinary environment at NTNU and have access to excellent facilities such as a modern library, study rooms and computer labs. Courses from a wide range of disciplines are involved and the globalization students will share experiences with students studying in an interdisciplinary master programme.

Content of the programme

Globalization and the increased interconnectedness created by the rapid flow of capital, people, goods, images and ideologies across national boundaries require a new set of specialized educational tools. The programme aims at making students understand the complex interactions between the political, economic, cultural and social trends which profoundly affect our daily lives in the contemporary world. The student will gain:

- an interdisciplinary perspective on the implications of globalization on civil society, state power, changing patterns of national culture and global markets and technologies
- a clear understanding of the effects of globalization on key actors in the global arena, such as NGOs, global corporations, international campaigning groups, states or multilateral institutions
- the ability to employ interdisciplinary approaches to the practical challenges posed by globalization through an internship undertaken in a global company or organization

Career opportunities

The Master's programme's specialization in Global Politics and Culture is designed to provide its students with the specialist knowledge and transferable skills to pursue careers in global corporations, non-governmental organizations (NGOs), and international campaigning groups, the civil and diplomatic services or in the media, research and information sectors. By the end of their degree, students will have proved their capacity to engage in team work, gained relevant work experience in a global corporation or organization and demonstrated their ability to employ interdisciplinary approaches at both theoretical and practical levels.

Admission requirements

- Successful applicants must have achieved a minimum of the equivalent of a C grade (Norwegian grading system) in their undergraduate degree to be accepted onto this Master's programme, in accordance with NTNU regulations.
- Students with a BA in Humanities or Social Sciences with a specialization of minimum 80 ECTS credits in a discipline with relevance to the MSc in Globalization's academic components or equivalent from a university or college defined as:
- Political Science
- Sociology
- Social Anthropology
- History
- Geography
- European Studies
- Economics
- Development Studies
- Religious Studies
- International Relations

For the Global Politics and Culture Specialization, English language requirements for international students are TOEFL 600/90 paper based / internet based or IELTS with 6.5 or better.

STRUCTURE

The Master's programme in Globalization is a two year programme, which awards a total of 120 ECTS credits, 30 credits per semester over four semesters.

Core courses

Code	Title	Cr.	Term	Admis-sion	Comp.	Pre.
GEOG3003	Methodology and the Research Process	7.5	Autumn/	Open	X	X
GEOG3005*	Qualitative Methods	7.5	Spring	Open	X	X
GEOG3006*	Quantitative Methods	7,5	Spring	Open	X	X
GEOG3053	Discourses of Development and Globali-zation	7.5	Autumn	Open	X	X
GEOG3518	Knowledge Management in a Global Economy	7.5	Autumn	Open	X	X
HIST3295	Contemporary International Economic History	7.5	Autumn	Open	X	X
SANT3508	Globalization, Theory and Culture	7.5	Spring	Open	X	X
**	Internship / Work Project	30	Autumn	***		
**	Master's Thesis in Globalization	30	Spring	***		

Compulsory: The subject's compulsory activity must be passed to sit the exam. You are advised to read the subject description for more information.

Prerequisite: Prerequisites must be satisfied to be able to enroll in this subject. You are advised to read the subject description for more information.

* Students must choose either GEOG3005 or GEOG3006.

** The course code depends on the student's departmental belonging.

*** Requires admission to the program of study (MSc in Globalization, Politics and Culture).

Electives

Code	Title	Cr.	Term	Admis-sion	Comp.	Pre.
RVI2175	Religion, Science and Technology in a Global Society*	15	Spring	Open	X	
RVI2115	Religion, Politics and Science in Global Society*	15	Spring	Open	X	
SARB3512	Immigration, integration , Diversity II	15	Spring	Open	X	X
SØK2006	International Trade***	7.5	Spring	Open	X	
SØK2007	Development Economics***	7.5	Spring	Open	X	
TIØ4261**	Green Value Creation and Ethical Perspec-tives	7.5	Spring	Open	X	
TIØ5215**	Global Governance of Sustainable Supply Chains	7.5	Spring	Open	X	

Compulsory: The subject's compulsory activity must be passed to sit the exam. You are advised to read the subject description for more information.

Prerequisite: Prerequisites must be satisfied to be able to enroll in this subject. You are advised to read the subject description for more information.

* RVI2115 will alternate every second year with RVI2175. RVI2175 will NOT be lectured spring 2015.

** TIØ4260 and TIØ5215 must be taken as a pair, not separately.

*** SØK2006 and SØK2007 must be taken as a pair, not separately.

MSc in Globalization, specializing in Global Politics and Culture, programme structure:

<table>
<tr><th>Term</th><th>7.5 credits</th><th>7.5 credits</th><th>7.5 credits</th><th>7.5 credits</th></tr>
<tr><td>4th sem. Spring</td><td colspan="4">Master's Thesis in Globalization***</td></tr>
<tr><td>3rd sem. Autumn</td><td colspan="4">Internship***</td></tr>
<tr><td rowspan="5">2nd sem. Spring</td><td rowspan="5">GEOG3005 Qualitative Methods or GEOG3006 Quantitative Methods</td><td rowspan="5">SANT3508 Globalization, Theory and Culture</td><td colspan="2">RVI2175 Religion, Science and Technology in a Global Society (15 Cr.)*</td></tr>
<tr><td colspan="2">RVI2115 Religion, Politics and Science in Global Society (15 Cr.)*</td></tr>
<tr><td colspan="2">TIØ4261 Green Value Creation and Ethical Perspectives (7.5 Cr.) and TIØ5215 Global Governance of Sustainable Supply Chains (7.5 Cr.)**</td></tr>
<tr><td colspan="2">SARB3512 Innvandring, integrasjon og mangfold II (15 Cr.)</td></tr>
<tr><td colspan="2">SØK2006 International Trade (7.5 Cr.) and SØK2007 Development Economics (7.5 Cr.)***</td></tr>
<tr><td>1. sem. Autumn</td><td>GEOG3518 Knowledge Management in a Global Economy</td><td>HIST3295 Contemporary International Economic History</td><td>GEOG3003 Methodology and the Research Process</td><td>GEOG3053 Discourses of Development and Globalization</td></tr>
</table>

* RVI2115 will alternate every second year with RVI2175. RVI2115 will be lectured spring 2015.

** TIØ4260 and TIØ5215 must be taken as a pair, not separately

*** The course code depends on the student's departmental belonging.

INTERNSHIP

The internship provides a unique opportunity for students to develop and build their personal, academic and professional capacities by managing an individual project. The internship project should contribute an interdisciplinary perspective and should be relevant to the needs and requirements of the company/organization. It should lead to the production of a written academic assignment, which will be undertaken under the supervision of a supervisor at NTNU, and a corporate or organizational supervisor.

Internship Courses

Course	Department	Credits	Term	Admission
GEOG3012	Department of Geography	30	Autumn	*
HIST3012	Department of Historical Studies	30	Autumn	*
IØ3012	Department of Industrial Economics and Technology Management	30	Autumn	*
RVI3012	Department of Philosophy and Religious Studies	30	Autumn	*
SANT3012	Department of Social Anthropology	30	Autumn	*

* Requires admission to the programme of study (MSc in Globalization).

Students are supposed to choose a supervisor from one of the five departments at NTNU.

MASTER'S THESIS

The 30 ECTS credit Master's thesis should be between 50 and 70 pages in length (12 pt, 1.5 spacing). The contents of the thesis should fulfill an academic level appropriate to a Master's level course. Furthermore, it should relate to the interdisciplinary framework of the taught course element of the Master's programme. A project summary of 300 words should be written in the third semester followed by a more detailed proposal in the form of a written outline of the thesis (around 5 pages) at the beginning of the fourth semester. The thesis should be written over a 20-week period in the fourth semester. The deadline for submission of the thesis is normally May 1st. The students may apply for a two week extension. Students must have passed all the courses on the Masters programme before submitting the Master's thesis. Students must have passed their Master's thesis in order to present themselves for the 30-minute oral exam related to the Master's thesis. The grade for the Master's thesis may be adjusted after the oral exam. The Global Politics and Culture students will normally write their thesis at NTNU, and may relate its contents to the internship assignment.

Codes for the Master`s thesis

Course	Department	Credits	Term	Admission
GEOG3910	Department of Geography	30	Spring	*
HIST3910	Department of Historical Studies	30	Spring	*
IØ3910	Department of Industrial Economics and Technology Management	30	Spring	*
RVI3910	Department of PhilosophyReligious Studies	30	Spring	*
SANT3910	Department of Social Anthropology	30	Spring	*

* Requires admission to the study programme.

Students are supposed to choose a supervisor from one of the five departments at NTNU.

COURSE DESCRIPTIONS

Core courses

GEOG3003 Methodology and the Research Process

Teaching: Autumn: 7.5 Cr

Language of instruction: English

Credit reduction: GEOG3002: 7.5 Cr

Grade: Pass/Fail

Compulsory assignments: Field course preparations, presentation, field course with report

Required previous knowledge: Bachelor's degree in Social Sciences, Biology, Chemistry or Resource Geology or the equivalent. Other relevant qualifications can be accepted by the Department of Geography. The course is also open for students admitted to the 5-year teacher training programme in Geography.

Learning objectives: The course gives the students a deeper knowledge on stages of the research process and relations to the common methodologies in the subject. The students should develop relevant skills and experience through participation in a limited field work based on relevant methods and disseminate their research results.

Academic content: The course focuses on getting started in geographical research at master level. It is comprised of two main parts: (1) a lecture / seminar part, (2) a field course with additional preparations and seminars. Various methodologies are practiced during the field course, in which students work in groups on particular topics and research objectives. The group work will form part of a common field course report.

Emphasis is placed on developing a critical and reflexive attitude to the choice of research objective, research questions and the application of different methodologies. Some lectures will address the process with developing research objectives and choice of methodology for the master thesis. This process will end in a project assignment which delimits the theme, research objectives / questions and an assessment of research design, appropriate methodology and broader methods in the planned master thesis.

Teaching methods and activities: Field course, lectures: 10 hours, seminars: 8 hours.

It is expected that compulsories and examinations must be completed in English. Exceptions must be clarified with the lecturer responsible for the course.

Assessment: Assignment

Forms of assessment	Time	Percentage	Deadline
Assignment			

GEOG3005 Qualitative Methods

Teaching: Both autumn and spring: 7.5 Cr

Language of instruction: English

Credit reduction: GEOG3002: 7.5 Cr, GEOG3052: 7.5 Cr, AFR3002: 7.5 Cr, AFR3005: 7.5 Cr, GEOG3004: 7.5 Cr

Grade: Pass/Fail

Compulsory assignments: Reflection notes/individual assignment

Recommended previous knowledge: See required previous knowledge.

Required previous knowledge: GEOG3003. Other relevant qualifications may be accepted by the Department of Geography. It is optional for those attending the 5-year teacher training programme in Geography (master).

Learning objectives: Knowledge: Obtain an advanced understanding of methodological principles, core concepts and techniques in qualitative Research.

Skills: Be able to discuss, apply and assess adequate qualitative methods in relations to a chosen Research design.

General competency: Be able to write an independent assignment focusing on research design or specific aspects of qualitative research.

Academic content: The course focuses on qualitative methodology, such as case study, ethnography, multi-sited methodology, feminist methodology, and discourse analysis. Major emphasis will be on positioning, representation, reflexivity, ethics, and interpretations. Through lectures and exercises skills about how to generate data, conduct analysis and write-up the material when adopting methods such as interviews, focus groups discussions, observation, and text and image analyses are taught. The students will be able to try method(s) that

they will adopt in their master thesis, and they will have to write an assignment in which they reflect upon their choice of methodology in their own master thesis.

Teaching methods and activities: Autumn semester: Reading course only.

Spring semester: 14 hours lectures, 6 hours exercises.

It is expected that compulsories and examinations must be completed in English. Exceptions must be clarified with the lecturer responsible for the course.

Assessment: Oral examination

Forms of assessment	Time	Percentage	Deadline
Oral examination			

GEOG3006 Quantitative Methods

Teaching: Spring: 7.5 Cr

Language of instruction: English

Credit reduction: GEOG3002: 7.5 Cr, GEOG3052: 7.5 Cr, GEOG3004: 7.5 Cr, AFR3002: 7.5 Cr, AFR3005: 7.5 Cr

Grade: Pass/Fail

Compulsory assignments: Seminar presentation, group assignment and individual assignments.

Recommended previous knowledge: See required previous knowledge.

Required previous knowledge: GEOG3003. Other relevant qualifications may be accepted by the Department of Geography.

Learning objectives: The course gives the students deeper insight in the use of questionnaires and application of selected quantitative methods. Students should be able to apply these methods and techniques, overview their possibilities and limitations and give an adequate interpretation of the (analytical) results in their master thesis.

Academic content: The course pursues methodologies into a quantitative array of research schemes. It comprises four parts. (1) The course starts with lectures on questionnaire, (2) followed by group work on construction and presentation of a pilot questionnaire. Part 3 comprises lectures and exercises based on the use of a statistical software package (SPSS) for analysis of data. The main focus will be on statistical analyses of available data (database), however entering questionnaire data with further analyses may be an option. A research design comprising correlation and regression will be presented, as will other analytical techniques based on the students specific needs. In part 4, students will prepare an assignment in which they reflect on their choice of specific and appropriate methods and techniques directly related to their master thesis.

Teaching methods and activities: Lectures: 10 hours. Seminars: 10 hours. Exercises: 8 hours. It is expected that compulsories and examinations must be completed in English. Exceptions must be clarified with the lecturer responsible for the course.

Assessment: Oral examination

Forms of assessment	Time	Percentage	Deadline
Oral examination			

GEOG3053 Discourses of Development and Globalization

Teaching: Autumn: 7.5 Cr

Language of instruction: English

Credit reduction: GEOG3050: 7.5 Cr, GEOG3504: 7.5 Cr, SVGEO350: 7.5 Cr

Grade: Letter grade

Compulsory assignments: Assignment

Required previous knowledge: Bachelor in social science. Other relevant qualifications can be accepted upon approval by the Department of Geography.

Learning objectives: Students shall broaden their knowledge of theories of social change through an introduction to different analytical perspectives in development theory and practice.

Academic content: GEOG3053 Discourses of Development and Globalization is an introductory theory course, dealing with fundamental issues of development and globalization and how development and globalization are related. Different theories and key concepts will be introduced and examined with respect to development challenges of our times, such as poverty alleviation and growth, mobility, livelihoods, globalization and marginalization, rights, civil society. The course draws on a wide range of practical and empirical knowledge, as the lecturers represent different areas of specialization within the social sciences and many have cross-cultural experience.

Teaching methods and activities: Lectures, 20 hours and assignment.

It is expected that compulsories and examinations must be completed in English. Exceptions must be clarified with the lecturer responsible for the course.

Assessment: Written examination

Forms of assessment	Time	Percentage	Deadline
Written examination	4 Hours		

GEOG3518 Knowledge Management in a Global Economy

Teaching: Autumn: 7.5 Cr

Language of instruction: English

Grade: Letter grade

Compulsory assignments: Semester assignment.

Required previous knowledge: Bachelor in social science. Other relevant qualification can be accepted upon by approval by the Department of Geography. Students with no background in social sciences are recommended to read an introductory book

Learning objectives: The students shall gain theoretical knowledge about economic, political and cultural aspects of industrial globalization. The central aim is to provide a comprehensive insight into the relations between processes of globalization and company strategies. The course provides skills in academic writing on these topics.

Academic content: The course offers different perspectives on globalization, together with discussions on how this influences actions and strategies of enterprises and national states. Focus is particularly on business practices in a globalized knowledge economy. Case examples illustrate how businesses can draw on their surroundings and networks locally, regionally, nationally and internationally in their endeavours to innovate. The course presents how strategies and actions occur at the interface between economy, politics and culture. Knowledge development across cultural boundaries is thus a central theme. As part of the course the students have to write an individual semester assignment. The semester assignment must be approved before the examination can be taken.

Teaching methods and activities: 18 hours lectures and assignment. The compulsory assignment and the exam must be completed in English. Exceptions must be clarified with the lecturer responsible for the course.

Please note that the course may be cancelled due to the teaching capacity at the Department of Geography or if less than 5 students register for the course. Check www.ntnu.no/geografi/studentinformasjon for updated information. The webpage will be updated 10th of January in the spring semester and 10th of August in the autumn semester.

Assessment: Written examination

Forms of assessment	Time	Percentage	Deadline
Written examination	4 Hours		

HIST3295 International Economic Contemporary History

Teaching: Autumn: 7.5 Cr

Language of instruction: English

Grade: Letter grade

Compulsory assignments: Approved assignment as part of group instruction/term paper

Recommended previous knowledge: None

Required previous knowledge: BA in History or equivalent

Learning objectives: A candidate who passes this course is expected to have the following learning outcome according to the course curriculum, defined as knowledge and skills:

Knowledge:

Candidate

- Should especially get an overview about periods of economic globalization and of economic de-globalization during the last 150 years as well as about their characteristics.
- Should learn to identify the factors causing these developments and to analyze and describe from different perspectives and based on different country case studies both the direct effects and repercussions of economic globalization and of economic de-globalization.
- Should learn to interpret and to contextualize historical statistics.

Skills:

Candidate

- Should learn to write and to structure a short essay in a proper way as well as to find sources and literature.
- Should get good knowledge about the history of globalization and about the basics of development theories and trade theory

Academic content: Economic globalization processes cannot only be observed for the most recent decades; rather they occurred also in earlier periods. This course will provide an overview about globalization and de-globalization during the last hundred years, i.e. covering the period between the outbreak of World War I and today. It will especially try to answer the following questions: How did economic globalization develop and what different periods can be observed during the period examined? What are the specific characteristics of these periods? Which factors caused globalization and de-globalization? Which conditions favored or hampered its development? What effects did globalization and de-globalization have in different respects? And what repercussions, in turn, did these effects have on the further development of globalization? We will further discuss, based on country case studies, why the economic effects of globalization and the reactions to globalization differed among different countries.

Teaching methods and activities: Lectures and seminars.

Assessment: Home examination

Forms of assessment	Time	Percentage	Deadline
Home examination	4 Days		

SANT3508 Globalization Theory and Culture

Teaching: Spring: 7.5 Cr

Language of instruction: English

Credit reduction: SANT3507: 5.0 Cr

Grade: Letter grade

Compulsory assignments: Written assignment

Required previous knowledge: Either 60 ECTS in Social Anthropology or a bachelor's degree or equivalent.

Learning objectives: The candidate has attained

- a broad understanding of the key concepts of globalization theory
- knowledge of various theories of globalization processes
- insight into recent research pertaining to globalization processes

Skills:

The candidate has acquired skills to

- asses the implications of globalization for people's everyday life
- analyze the construction of meaning, identity and subjectivity in a globalized world
- analyze the construction of new social imaginaries and cultural repertoires in a globalized world

Academic content: Globalization is the buzzword of the 21st century. If we live in a globalized world, what does this mean for our economics, our culture, our work and leisure, even our sense of ourselves? The course offers a survey of the major theories and debates of globalization. The course examines in addition the social and cultural aspects of globalization processes.

Globalization processes refers to the intensification of global interconnectedness which entails increased standardization, homogenization and universalization as Western ideologies circulate more widely. Accommodating unifying and standardizing and universalizing impulses, however, we also find more heterogeneous, particular and local expressions, hybridization, creolization and forms of resistance. The deterritorialization of culture and the global flow of commodities, advertising and media give rise to new premises for the construction of meaning, identity and subjectivity, along with new social imaginaries and cultural repertoires.

Course materials: See reading list available at the beginning of the semester.

Teaching methods and activities: Lectures, seminars and written assignment.

Assessment: Written examination

Forms of assessment	Time	Percentage	Deadline
Written examination	**4 Hours**		

Electives

RVI2115 Religion, Politics and Science in Global Society

Teaching: Spring: 15.0 Cr

Language of instruction: English

Credit reduction: RVI2110: 7.5 Cr

Grade: Letter grade

Compulsory assignments: Presentation, 80 % attendance

Recommended previous knowledge: Skills equivalent to one year of university studies, including basic courses in religious studies.

Required previous knowledge: None.

Learning objectives: According to the course curriculum, a candidate who passes this course is expected to have the following learning outcome (defined as knowledge and skills)

Knowledge:

The candidate has attained

- insight into recent research pertaining to the course's research questions
- the ability to update his/her own knowledge of the disciplines research questions
- knowledge of what constitutes good scientific practice regarding sources and references

Skills:

The candidate has acquired skills to

- analyse the roles which religion plays both for trans-national actors and international organisations, and their conceptions of nation, ethnicity and science
- analyse how religion is expressed by these actors and organisations in current global debates about democracy, human rights, and science, and their reception in national debates about multiculturalism and integration
- analyse the relationship between research problems and policy problems

Academic content: The course focuses on the activities of trans-national actors and international organisations, and the conceptions of religion, nation, ethnicity and science which guide them. Regional focus is mainly (but not exclusively) the Middle East. Examples of relevant problem-areas are debates about multiculturalism and integration on national levels, and the corresponding debates about democracy, human rights, science, natural resources, and security on the level of the global society. The course will also provide further study of the methodological and theoretical issues related to the study of religion, as well as deeper study of selected topics in the history of the discipline. The course will thereby provide a further understanding of various approaches, how theories are formed, and related issues.

Course materials: The required reading list will be available at the beginning of the semester.

Teaching methods and activities: The teaching consists of lectures and seminars. The lectures and seminars aim at outlining broad frameworks for thinking about the issues which are treated in the course readings, and raising the policy issues touched upon. In order to take the exam the students have to attend at least 80 % of the teaching, and pass three assessment thresholds, subject to the lecturer's evaluation. The exam consists of a written assignment (8000 words).

Assessment: Assignment

Forms of assessment	Time	Percentage	Deadline
Assignment			

RVI2175 Religion, Science and Technology in a Global Society

Teaching: Spring: 15.0 Cr

Language of instruction: English

Grade: Letter grade

Compulsory assignments: Presentation, 80 % participation

Recommended previous knowledge: Skills equivalent to one year of university studies, including basic courses in religious studies.

Required previous knowledge: None.

Learning objectives: According to the course curriculum, a candidate who passes this course is expected to have the following learning outcome (defined as knowledge and skills):

Knowledge:

The candidate has attained

- a broad understanding of the ?deep? history of science and religion
- knowledge of the use of science from within different global religions
- insight into recent research pertaining to the questions above
- the ability to update his/her own knowledge of the disciplines research questions

Skills:

The candidate has acquired skills to #8232;

- analyse the relationship between technology and value systems such as religion in different parts of the world
- analyse the construction of the following categories in specific global contexts: religion, nature, technology and science
- analyse the relationships between such categories (technology and nature, etc.?) in various media, such as film and Internet
- apply tools from the mind sciences to cultural and religious studies

Academic content: Technologies both free and enslave us. They seem magical in the sense that we often have very little idea how they work. They also have deep implications about what we value and even what we value ultimately. Although the use of technology can be said to define what it means to be human (for example, in our use of tools), the present-day global focus on the consumption of technology has become so important and valued that it may even constitute a religion. Some of us hold onto the myth that we can be saved by technology, while some hold onto the myth that technology will ultimately destroy us. As such, the course will delve into methodological and theoretical questions from the study of religion, in particular, to pose the argument that religion is primarily about how we as humans relate to and value these ?transcendent? technologies.

This course thus looks into the implications that the adoption of universal scientific and technological models has for us as global subjects. It will examine the historical interaction between science and world religions. Students will also be pushed to think about the transnational consumption and circulation of religious, scientific, and technological goods. We will explore both the historical and modern use of religion, science, and technology to “modulate” human cognition (technologies of the self).

The course will also turn these questions around in an attempt to integrate empirically grounded scientific research of the human condition with humanistic approaches. We will examine how models from biology (such as evolution, ethology, and the endocrinology of emotions) and the mind sciences (neuroscience, philosophy, cybernetics, evolutionary psychology, among others) are applied broadly to explaining and understanding culture, and specifically to explaining and understanding science and religion. With regard to culture, we will examine the consumption of sex, food, and information and the ways in which they are technologically mediated around the world (through Internet, film and other media, fast food,

marketing, universities, etc.?). With regard to science and religion, we will explore arguments about their biological and cognitive foundations.

Among the pertinent questions we will ask are: What does it mean to be human? Is modern consumer culture a religion? What is its history? How have different global religions understood and employed science? How have technologies changed the human relationship with our environment and our relations with other animals? What are the possible consequences of such technology for life on our planet? Do theories from cognitive science and biology assist us in making sense of human practices such as religion? What are those theories? Are there ritual origins for the use of technology among humans?

Course materials: The required reading list will be available at the beginning of the semester.

Teaching methods and activities: The teaching consists of lectures and seminars. The lectures and seminars aim at outlining broad frameworks for thinking about the issues that are treated in the course readings. In order to take the exam the students have to attend at least 80 % of the teaching, and pass three assessment thresholds, subject to the lecturer's evaluation. The exam consists of a written assignment (8000 words).

Assessment: Assignment

Forms of assessment	Time	Percentage	Deadline
Assignment			

SARB3512 Immigration, Integration, Diversity II

Teaching: Spring: 15.0 Cr

Language of instruction: English, Norwegian

Credit reduction: SARB3511: 7.5 Cr

Grade: Letter grade

Compulsory assignments: Approved subject and individual selected reading list 15.nov/1.mai

Recommended previous knowledge: Bachelor's degree or the equivalent in health Science, Social work, or the Social Sciences.

Required previous knowledge: Bachelor's degree.

Learning objectives: One important aim of this course is to contribute to reflection and critical discussion of both the aims and the means of immigration politics.

Academic content: This course gives a survey on perspectives and recent research within the field of immigration. Central themes will be immigration and integrational politics and problems related to the reception and settlement of refugees. The course will address central issues such as culture and ethnicity, discrimination and racism, qualifications and diversity.

Course materials: The reading list is 600-800 pages, of which 200-300 pages are individually selected and come in addition to the reading list of SARB3511.

Teaching methods and activities: Teaching method and activities: Lectures, seminars and written assignment.

Compulsory activity: Approved topic and curriculum for term paper.

Form of assessment: Term paper.

Assessment: Assignment

Forms of assessment	Time	Percentage	Deadline
Assignment			

SØK2006 International Trade

Teaching: Spring: 7.5 Cr

Language of instruction: English

Credit reduction: SØK2003: 7.5 Cr

Grade: Letter grade

Compulsory assignments: One approved term paper.

Recommended previous knowledge: SØK1000, SØK1001 and SØK1002 (or SØK1000 and SØK1010)

Required previous knowledge: None

Learning objectives: Knowledge

You learn

- economic theory about international trade and international division of production
- driving forces behind international trade and international mobility of factors of production
- why international trade gives welfare gains and has distributional consequences
- the importance of "comparative advantages"
- causes of intra-industry trade and the importance of economic geography
- the relationships between trade, industry structure and patterns of specialization
- the importance of different types of economies of scale in production
- the effects of trade policies for countries and industries
- the role of the World Trade Organization (WTO)

Skills

You should be able to

- use graphs and some algebra to analyze economic questions related to international trade
- master general equilibrium theory in order to understand relationships between industry structure, product prices, and factor prices
- understand interrelated forces in single markets and analyze trade policy effects
- analyze the impact of trade on industry structure and welfare

independently judge arguments about effects of international trade

General competence

You should be able to

- follow economic reasoning related to the course in the public debate and professional reports

Academic content: The course provides an introduction to international trade. The first part treats the theory of comparative advantages with an emphasis on the consequences on economic welfare, income distribution, and industry composition. The second part deals with intra-industry trade based on imperfect competition and economies of scale. The last part is on trade policy

Course materials: Announced at the beginning of the term.

Teaching methods and activities: 2 hours of lectures every week and 2 hours of practical assignments every second week. Compulsory activity: 1 approved term paper. The term paper can be written as a joint project by up to four students.

Assessment: Written examination

Forms of assessment	Time	Percentage	Deadline
Written examination	4 Hours		

SØK2007 Development Economics

Teaching: Spring: 7.5 Cr

Language of instruction: English

Credit reduction: SØK1102: 7.5 Cr

Grade: Letter grade

Compulsory assignments: One approved term paper.

Recommended previous knowledge: SØK1000, SØK1001 and SØK1002 (or SØK1000 and SØK1010)

Required previous knowledge: None

Learning objectives: Knowledge

You learn

- how to measure standards of living, extent of poverty and degree of inequality
- different theories of growth and development, including models emphasizing the role of human capital, international trade and rural-urban migration
- about factors affecting productivity in agriculture and industry
- about the role of foreign aid in economic development

Skills

You should be able to

- compare and evaluate different measures of living standards, poverty and inequality
- apply analytical and graphical models to analyze development issues and assess how economic policies can affect economic development
- use empirical evidence on the motivation behind aid allocation and the growth effects of aid to evaluate the role of foreign aid in economic development

General competence

You should be able to

- follow economic reasoning related to the course in the public debate and professional reports

Academic content: The course provides an introduction to the causes of economic underdevelopment and the conditions for economic development. The main features of economic underdevelopment are illustrated with empirical material. The course provides an overview of various theories of economic growth, and further considers topics like income distribution, measurement of poverty, interaction between traditional and modern sector, international trade and development aid.

Course materials: Announced at the beginning of the term.

Teaching methods and activities: 2 hours of lectures every week and 2 hours of practical assignment every second week. Compulsory activity: 1 approved term paper that can be written as a joint project by up to four students.

Assessment: Written examination

Forms of assessment	Time	Percentage	Deadline
Written examination	4 Hours		

TIØ5215 Global Governance of Sustainable Supply Chains

Teaching: Spring

Language of instruction: English

Grade: Letter grade

Compulsory assignments: Exercises

Learning objectives: The position of the course: The course is obligatory in the project management program (MSPROMAN) and can be chosen as an elective by other study programs. It is particularly well suited for MTIØT, MIHMS and MSINDECOL.

The course will give the following knowledge:

- General knowledge about global framework for green business, supply and value chains based on the principles of social responsibility including human rights, rights and protection of workers and ecological sustainability and resilience

- General knowledge about suppliers and supply chain logistics

- Specific knowledge about SHE-legislation and practice in Norway

- Specific knowledge about utilization of international standards, tools and measures for analysing, implementing evaluating ad reporting on SR-challenges within the context of holistic systems understanding

- Specific knowledge about facilitation of environmental and SHE-management as integrating part along the value and supply chain by using sustainable logistic and green purchasing and procurement

- Specific knowledge about the principles of sustainability in purchasing, and the buyers responsibility for supply network sustainability

Competences developed in this course:

- Competence to apply systems theory in analyzing and implementing SR and SHE principles and methods as integrated parts of supply and value chains for global enterprises and large projects

- Competence to apply network analysis to the responsibility of a buyer in dealing with a supply chain or network.

Other important learning outcomes:

- By means of theory and exercises, the student will be able to reflect on ethical issues connected to SR, supply chains and purchasing for promotion of sustainable industrial projects and value chains

- Through the group work in the exercise, the student will develop his or her skills of working in groups, and in helping groups to function effectively

- Through the group work, students will develop their skill of analysing and discussing a scientific problem

- the report of the exercise will give the student a chance to develop their skills in writing scientific reports.

Recommended previous knowledge: Obligatory courses in the project management program or the Health, Environment and Safety program.

Academic content: Organization of green supply management programs, including relationships to suppliers, structuring of suppliers and green procurement and purchasing. Particular focus is given to challenges related to suppliers from other parts of the world, and the responsibility that Norwegian companies may have to make sure that their suppliers are acting according to national and international regulations and good Social Responsibility (SR) and Corporate Social Responsibility (CSR) practices. The supply management challenges of small projects and temporary organizations with limited staff capacity are also included.

Principles for SR founded on global sustainable governance, international standards, planetary boundaries and resilience, international agreements and initiatives(UN, OECD, EU, Global Compact, WPCSD, standards (ISO 26000 etc.), DPSIR) and how SR is related to the Norwe-

gian Systematic Health, Environmental and Safety Activities in Enterprises - SHE Internal Control Regulations.

Ethical reasoning, interests and rights connected to workers, labor organizations, NGOs, developing countries, society and ecological sustainability related to projects and global enterprises, and methods and tools for development of strategies and implementation of CSR-systems along the value chain and reporting, including Global Reporting Initiative, and indexes for companies sustainability.

Teaching methods and activities: Lectures and a written exercise. The exercise is compulsory and done in groups. Portfolio assessment is the basis for the grade in the course. The portfolio includes a final written exam (60%) and the exercise (40%). The results for the parts are given in %-scores, while the entire portfolio is assigned a letter grade. Exercises are adjusted to the students study programme. Postponed/repeated exams may be oral. The course is in English.

Course materials: To be announced.

Assessment: Portfolio assessment

Forms of assessment	Date/Time	Percentage	Exam. support
Written examination	To be announced on the web	60/100	A
Work		40/100	

Internship courses

GEOG3012 Internship

Teaching: Autumn: 30.0 Cr

Language of instruction: English

Credit reduction: GEOG3011: 22.5 Cr

Grade: Pass/Fail

Compulsory assignments: Internship

Required previous knowledge: Requires admission to the Master's programme in Globalization.

Learning objectives: The learning objectives are to develop and build the personal, academic and professional capacities of the students by allowing them to research and manage an individual work project within a global company/organization or a work project at NTNU in cooperation with an international company/organization, using interdisciplinary approaches.

Academic content: The students will undertake an internship project and must complete an assignment. The assignment has to fulfill the academic requirements of a master's level programme. The assignment has to be an academic piece of work which has to refer to, or include parts of, the internship project. The following are examples of the areas of research covered by the course, and which the internship project could relate to: International Political Economy, International Relations, Social Change, Marginalization and Mobility, Conflict and Peace, Cultural Knowledge, Cross-cultural Management, Knowledge and Technology Transfer and Translation.

Teaching methods and activities: The students will have individual supervision from both NTNU and the internship/work place.

A compulsory written assignment relating to the internship/work project (between 35 and 40 pages; 12 pt, 1.5 spacing) should be submitted to the NTNU supervisor by 15 December. The assignment will be given a pass/fail grade by the NTNU supervisor.

Assessment: Assignment

Forms of assessment	Time	Percentage	Deadline
Assignment			

HIST3012 Internship

Teaching: Autumn: 30.0 Cr

Credit reduction: HIST3011: 22.5 Cr

Grade: Pass/Fail

Compulsory assignments: None

Required previous knowledge: Requires admission to the Master's programme in Globalization.

Learning objectives: The learning objectives are to develop and build the personal, academic and professional capacities of the students by allowing them to research and manage an individual work project within a global company/organization or a work project at NTNU in cooperation with an international company/organization, using interdisciplinary approaches.

Academic content: The students will undertake an internship project and must complete an assignment. The assignment has to fulfill the academic requirements of a master's level programme. The assignment has to be an academic piece of work which has to refer to, or include parts of, the internship project. The following are examples of the areas of research covered by the course, and which the internship project could relate to: International Political Economy, International Relations, Social Change, Marginalization and Mobility, Conflict and Peace, Cultural Knowledge, Cross-cultural Management, Knowledge and Technology

Transfer and Translation.

Teaching methods and activities: The students will have individual supervision from both NTNU and the internship/work place.

A compulsory written assignment relating to the internship/work project (between 35 and 40 pages; 12 pt, 1.5 spacing) should be submitted to the NTNU supervisor by 15 December. The assignment will be given a pass/fail grade by the NTNU supervisor.

Assessment: Report

Forms of assessment	Time	Percentage	Deadline
Approved report			

IØ3012 Internship/Work Project

Language of instruction: English

Credit reduction: IØ3011: 22.5 Cr

Grade: Pass/Fail

Compulsory assignments: None

Learning objectives: The learning objectives are to develop and build the personal, academic and professional capacities of the students by allowing them to research and manage an individual work project within a global company/organisation, or a work project at NTNU in cooperation with an international company/organisation, using interdisciplinary approaches.

Required previous knowledge: Requires admission to the Master's programme in Global Politics and Culture. or Global Manufacturing Management.

Academic content: The students in the Global Politics and Culture will undertake an internship project and must complete an assignment. The assignment has to fulfil the academic requirements of a master's level programme. The assignment has to be an academic piece of

work which has to refer to, or include parts of, the internship project. The following are examples of the areas of research covered by the course, and which the internship project could relate to: International Political Economy, International Relations, Social Change, Marginalization and Mobility, Conflict and Peace, Cultural Knowledge, Cross-cultural Management, Knowledge and Technology Transfer and Translation.

The students in the Global Manufacturing Management will undertake a work project at NTNU, linked to the university's cooperation projects with industry, on a topic relevant for globalization. The following are examples of the areas of research covered by the course, and which the internship project could relate to: Production Strategy, Technology and ICT Management, Supply Chain Management, Operations Management or Project Management. The Global Manufacturing Management students must write an assignment which fulfils the academic requirements of a master's level programme. The assignment has to be an academic piece of work which has to refer to, or include parts of, the work project.

Teaching methods and activities: The students from both programs will have individual supervision from both NTNU and the internship/work place. the assignment is to be submitted to the student's NTNU supervisor.

A compulsory written assignment relating to the internship/work project (between 50 and 55 pages; 12 pt, 1.5 spacing) should be submitted to the NTNU supervisor by 15 December. The assignment will be given a pass/fail grade by the NTNU supervisor.

Assessment: Report

Forms of assessment	Date/Time	Percentage	Exam. support
Approved report			

RVI3012 Internship

Teaching: Autumn: 30.0 Cr

Credit reduction: RVI3011: 22.5 Cr

Grade: Pass/Fail

Compulsory assignments: Internship

Required previous knowledge: Requires admission to the Master's programme in Globalization.

Learning objectives: The learning objectives are to develop and build the personal, academic and professional capacities of the students by allowing them to research and manage an individual work project within a global company/organisation or a work project at NTNU in cooperation with an international company/organisation, using interdisciplinary approaches.

Academic content: The students will undertake an internship project and must complete an assignment. The assignment has to fulfil the academic requirements of a master's level programme. The assignment has to be an academic piece of work which has to refer to, or include parts of, the internship project. The following are examples of the areas of research covered by the course, and which the internship project could relate to: International Political Economy, International Relations, Social Change, Marginalization and Mobility, Conflict and Peace, Cultural Knowledge, Cross-cultural Management, Knowledge and Technology Transfer and Translation.

Teaching methods and activities: The students will have individual supervision from both NTNU and the internship/work place.

A compulsory written assignment relating to the internship (between 35 and 40 pages; 12 pt, 1.5 spacing) should be submitted to the NTNU supervisor by 15 December. The assignment will be given a pass/fail grade by the NTNU supervisor.

Assessment: Assignment

Forms of assessment	Time	Percentage	Deadline
Assignment			

SANT3012 Internship

Teaching: Autumn: 30.0 Cr

Language of instruction: English

Grade: Pass/Fail

Compulsory assignments: None

Required previous knowledge: Requires admission to the Master's programme in Globalization.

Learning objectives: The learning objectives are to develop and build the personal, academic and professional capacities of the students by allowing them to research and manage an individual work project within a global company/organisation, or a work project at NTNU in cooperation with an international company/organisation, using interdisciplinary approaches.

Academic content: The students will undertake an internship project and must complete an assignment. The assignment has to fulfill the academic requirements of a master's level programme. The assignment has to be an academic piece of work which has to refer to, or include parts of, the internship project. The following are examples of the areas of research covered by the course, and which the internship project could relate to: International Political Economy, International Relations, Social Change, Marginalization and Mobility, Conflict and Peace, Cultural Knowledge, Cross-cultural Management, Knowledge and Technology

Transfer and Translation.

Teaching methods and activities: The students have individual supervision from both NTNU and the internship/work place. A compulsory written assignment relating to the internship/work project (between 35-40 pages; 12 pt., 1.5 spacing) should be submitted to the NTNU supervisor by 15 December. The assignment will be given a pass/fail grade by the NTNU supervisor.

Assessment: Report

Forms of assessment	Time	Percentage	Deadline
Approved report			

Master's Thesis Codes

GEOG3910 Master's Thesis in Globalization

Teaching: Spring: 30.0 Cr

Language of instruction: English

Grade: Letter grade

Compulsory assignments: Project proposal

Required previous knowledge: Requires admission to the Master's programme in Globalization. The student must have completed 90 ECTS/credits within the programme.

Learning objectives: The students should be able to work with a specialized topic in an academic manner. The students will be trained in the formulation of research questions and in gathering and analyzing data. The students will achieve competency in analyzing processes of change related to globalization.

Academic content: The academic content of the Master's thesis must include a scientific investigation of a theme related to globalization. The thesis must be written in English. It

should be between 50 and 70 pages (12 pt, 1.5 spacing), and should demonstrate the student's ability to carry out an independent scientific research task. The content of the thesis should fulfill an academic level appropriate to a Master's level course, and relate to some of the aspects of the interdisciplinary framework of the courses taught in the Master's programme. The topic for the Master's thesis is selected in consultation with a supervisor.

Teaching methods and activities: Individual supervision. Compulsory assignments: A project summary of 300 words should be written in the third semester followed by a more detailed proposal in the form of a written outline of the thesis (around 5 pages) at the beginning of the fourth semester. Both project summary and project proposal should be submitted to the supervisor. Assessment: Thesis and 30 minutes oral examination.

The deadline for submission of the Master's thesis is normally 1 May. The student must have passed all courses in the Master's programme before the Master's thesis can be submitted. The Master's thesis must be approved before the student can present herself/himself for the 30 minute oral examination related to the Master's thesis. The oral examination is held in English. The grade for the Master's thesis may be adjusted after the oral examination.

Assessment: Thesis

Forms of assessment	Time	Percentage	Deadline
Thesis			

HIST3910 Master's Thesis in Globalization

Teaching: Spring: 30.0 Cr

Language of instruction: English

Grade: Letter grade

Compulsory assignments: Project proposal

Required previous knowledge: Bachelor's degree in humanities, social sciences or technology. Requires admission to the Master's Programme in Globalization. The student must have completed 90 ECTS/credits within the programme.

Learning objectives: A candidate who passes this course is expected to have the following learning outcome according to the course curriculum, defined as knowledge and skills:

Knowledge

The Candidate:

- should achieve an extended competence in analysing processes related to globalization by focusing on a well-defined topic

Skills

The Candidate:

- should learn to treat a specialized topic in an academic manner
- should learn to formulate research questions
- should learn to find and analyse qualitative and quantitative sources
- should learn to write in English

Academic content: The academic content of the Master's thesis must include a scientific investigation of a theme related to globalization. The thesis must be written in English. It should be between 50 and 70 pages (12 pt, 1.5 spacing), and should demonstrate the student's ability to carry out an independent scientific research task. The contents of the thesis should fulfil an academic level appropriate to a Master's level course, and relate to aspects of the interdisciplinary framework of the taught course element of the Master's programme. The topic for the Master's thesis is selected in consultation with a supervisor.

The students in the Global Technology Management specialization will write their thesis in an international company or organization. The students in the Global Politics and Culture specialization will normally write their thesis at NTNU.

Teaching methods and activities: Individual supervision. Compulsory assignments: A project summary of 300 words should be written in the third semester followed by a more detailed proposal in the form of a written outline of the thesis (around 5 pages) at the beginning of the fourth semester. Both project summary and project proposal should be submitted to the supervisor. Assessment: Thesis and oral examination.

The deadline for submission of the Master's thesis is normally 1 May. The student must have passed all courses in the Master's programme before the Master's thesis can be submitted. The Master's thesis must be approved before the student can present herself/himself for the 30 minute oral examination related to the Master's thesis. The oral examination is held in English. The grade for the Master's thesis may be adjusted after the oral examination.

Assessment: Master's thesis

Forms of assessment	Time	Percentage	Deadline
Assignment		1/1	
Oral examination	30 Minutes		

IØ3910 Master's Thesis in Globalization

Lang. of instruction: English

Grade: Letter grade

Compulsory assignments: Project proposal

Learning objectives: The students should be able to treat a specialized topic in an academic manner. The students will be trained in the formulation of research questions and in gathering and analysing data. The students will achieve an extended competence in analysing processes of change related to globalization.

Required previous knowledge: Bachelor's degree in humanities, social sciences or technology. Requires admission to the Master's programme in Global politics and Culture or Global Manufacturing Management. The student must have completed 90 ECTS/credits within the programme.

Academic content: The academic content of the Master's thesis must include a scientific investigation of a theme related to globalization. The thesis must be written in English. It should be between 50 and 70 pages (12 pt, 1.5 spacing), and should demonstrate the student's ability to carry out an independent scientific research task. The contents of the thesis should fulfil an academic level appropriate to a Master's level course, and relate to aspects of the interdisciplinary framework of the taught course element of the Master's programme. The topic for the Master's thesis is selected in consultation with a supervisor.

The students in the Global Manufacturing Management will write their thesis in an international company or organization. The students in Global Politics and Culture will normally write their thesis at NTNU.

Teaching methods and activities: Individual supervision. Compulsory assignments: A project summary of 300 words should be written in the third semester followed by a more detailed proposal in the form of a written outline of the thesis (around 5 pages) at the beginning of the fourth semester. Both project summary and project proposal should be submitted to the supervisor.

Assessment: Thesis and oral examination.

The deadline for submission of the Master's thesis is normally 1 May. The student must have passed all courses in the Master's programme before the Master's thesis can be submitted. The Master's thesis must be approved before the student can present herself/himself for the 30 minute oral examination related to the Master's thesis. The oral examination is held in English. The grade for the Master's thesis may be adjusted after the oral examination.

Course materials: Will be announced at the beginning of the course.

Assessment: Thesis

Forms of assessment	Date/Time	Percentage	Exam. support
Thesis		1/1	
Oral examination	To be announced on the web		

RVI3910 Master's Thesis in Globalization

Teaching: Spring: 30.0 Cr

Language of instruction: English

Grade: Letter grade

Compulsory assignments: Project proposal

Required previous knowledge: Requires admission to the Master's programme in Globalization. The student must have completed 90 ECTS/credits within the programme.

Learning objectives: The students should be able to treat a specialized topic in an academic manner. The students will be trained in the formulation of research questions and in gathering and analyzing data. The students will achieve an extended competence in analyzing processes of change related to globalization.

Academic content: The academic content of the Master's thesis must include a scientific investigation of a theme related to globalization. The thesis must be written in English. It should be between 50 and 70 pages (12 pt, 1.5 spacing), and should demonstrate the student's ability to carry out an independent scientific research task. The contents of the thesis should fulfill an academic level appropriate to a Master's level course, and relate to some of the aspects of the interdisciplinary framework of the courses taught in the Master's programme. The topic for the Master's thesis is selected in consultation with a supervisor.

Teaching methods and activities: Individual supervision. Compulsory assignments: A project summary of 300 words should be written in the third semester followed by a more detailed proposal in the form of a written outline of the thesis (around 5 pages) at the beginning of the fourth semester. Both project summary and project proposal should be submitted to the supervisor. Assessment: Thesis and oral examination.

The deadline for submission of the Master's thesis is normally 1 May. The student must have passed all courses in the Master's programme before the Master's thesis can be submitted. The Master's thesis must be approved before the student can present herself/himself for the 30 minute oral examination related to the Master's thesis. The oral examination is held in English. The grade for the Master's thesis may be adjusted after the oral examination.

Assessment: Thesis

Forms of assessment	Time	Percentage	Deadline
Thesis			

SANT3910 Master Thesis in Globalization

Teaching: Both autumn and spring: 30.0 Cr

Language of instruction: English

Grade: Letter grade

Compulsory assignments: project proposal

Required previous knowledge: Requires admission to the Master's programme in Globalization. The student must have completed 90 ECTS/credits within the programme.

Learning objectives: The students should be able to work with a specialized topic in an academic manner. The students will be trained in the formulation of research questions and in gathering and analysing data. The students will achieve an extended competence in analyzing processes of change related to globalization.

Academic content: The academic content of the Master's thesis must include a scientific investigation of a theme related to globalization. The thesis must be written in English. It should be between 50 and 70 pages (12 pt, 1.5 spacing), and should demonstrate the student's ability to carry out an independent scientific research task. The contents of the thesis should fulfil an academic level appropriate to a Master's level course, and relate to some of the aspects of the interdisciplinary framework of the courses taught in the Master's programme. The topic for the Master's thesis is selected in consultation with a supervisor.

Teaching methods and activities: Individual supervision. Compulsory assignments: A project summary of 300 words should be written in the third semester followed by a more detailed proposal in the form of a written outline of the thesis (around 5 pages) at the beginning of the fourth semester. Both project summary and project proposal should be submitted to the supervisor. Assessment: Thesis and oral examination for 30 minutes.

The deadline for submission of the Master's thesis is normally 1 May. The student must have passed all courses in the Master's programme before the Master's thesis can be submitted. The Master's thesis must be approved before the student can present herself/himself for the 30 minute oral examination related to the Master's thesis. The oral examination is held in English. The grade for the Master's thesis may be adjusted after the oral examination.

Assessment: Thesis

Forms of assessment	Time	Percentage	Deadline
Thesis			

Exercise Physiology and Sport Sciences

2-year Master of Science (MSc)

Programme code: MSPORT
Webpage: www.ntnu.edu/studies/msport

This program description is valid for students admitted in the academic year 2014/2015.

Introduction

The Master of Science in Exercise Physiology and Sport Sciences is a research and thesis-based integrated program of study at the Faculty of Medicine. It is exclusively concerned with basic research training and comprises compulsory courses together with specialization courses dependent upon the research interest of students.

The MSc program is associated with the Exercise research group at the Department of Circulation and Medical Imaging. One of the main research interests of this group is to examine basic mechanisms behind central and peripheral limitations to the supply and demand of oxygen transport, and to identify training responses. The group is also involved in examining the mechanisms behind muscular and neural limitations to strength and coordination, the prescription of effective endurance and strength training, and the effects on top sports performance.

Another aspect is based upon the fact that the fastest developing diseases within the population, such as obesity, atherosclerosis, diabetes II, osteoporosis and chronic obstructive pulmonary disease, are related to inactivity. Furthermore, physical activity is a key determinant of energy expenditure, and is thus fundamental to energy balance and weight control. The MSc program aims to identify effective exercise programs for large populations as well as specific patients and risk groups in order to develop effective tools for prevention, treatment, and rehabilitation, and to provide detailed exercise training recommend-dations that will improve overall health. Effective new training interventions based on basic biological adaptations have positive effects and are effective treatments with high socioeconomic as well as quality of life outcomes.

Physiology has not just delivered huge advances in understanding, diagnosing, and treating human disease, but it is also the cornerstone of what is currently the major biomedical research push – translation research. Physiological research remains the essential links between genes and clinical care. Enormous amounts of new knowledge are barreling down the information highway, but they are not arriving at the doorstep of our patients. The MSc program is meant to play a role in ensuring the future of the discipline and, as a result, in translating basic discoveries into clinical care. Translational research just cannot be accomplished without physiology.

Scientific research on physical activity, sports and health has touches on biological (dose-response relations between physical activity and health) and psycho-social questions (how to change physical activity behavior). The role of physical activity in health promotion during the next decades is evidently crucial.

Learning Outcome

The graduated student should be able to:

- demonstrate a solid knowledge about Exercise Physiology and Sport Sciences, good experimental and theoretical skills, and competence to obtain and critically appraise own and already published experimental and theoretical data and to pursue a career in Exercise Physiology;

- show advanced knowledge in Exercise Physiology and Sport Sciences reaching from the molecular to whole body level, and have practical skills relevant for the field;
- have knowledge of relevant methodologies and techniques including both historical as well as more recent techniques;
- describe how physical activity and exercise influence the heart, arteries and skeletal muscles in our bodies, both for health and performance;
- identify and describe the limitations for the energy delivery and utilization, as well as the muscular and neural limitations for strength and coordination;
- understand and describe the beneficial effects of physical activity for successful aging and disease prevention, and prescribe effective training programs for treatment and rehabilitation;
- understand basic concepts and principles of statistical analysis, and to perform and interpret results from simple statistical analyses;
- have practical skills in how to apply their academic learning in a project work, and develop teamwork skills by learning from their own experience in collaborating on a joint project in an interdisciplinary team;
- recognize and validate problems; formulate and test hypotheses;
- evaluate and formulate a theoretical concept. Evaluation includes originality, independence and applicability;
- apply and adopt experimental methods to gain new knowledge within Exercise Physiology and Sport Sciences, and have practical skills relevant to perform the tests;
- carry out and present an experiment that can be developed to quality of an international peer-reviewed paper;
- present, evaluate and discuss scientific results in English (orally and in writing);
- reflect on the existence of ethical aspects, sound experimental approaches and scientific thinking;
- collect relevant background information about topics within Exercise Physiology and Sport Sciences;
- have knowledge about mainstream concepts of Exercise Physiology and Sport Sciences, advantages/limitations of its applications, history, traditions and the position in the society;
- apply his/her knowledge and capabilities to analyze and carry out complex experiments in not-familiar domains;
- prove capability to apply his/her knowledge to new domains within Exercise Physiology and Sport Sciences; has skills and knowledge to search for relevant data on his/her own scientific question, and can critically assess published data within the theoretical framework chosen for a particular project.
- summarize, document, report, and reflect on own findings.
- know how to participate in discussions, put forward his/her results both in a constellation of peers as well as for lay-people.
- prove capabilities to contribute to the generation of new idea/concepts/technical approaches to experimental research questions.

Target Groups and Admission Requirements

Candidates should hold a bachelor's degree (or 3-year equivalent), preferably within biochemistry, biology, exercise physiology/sport sciences, movement science, nursing, occupational therapy, physiotherapy, or similar fields. A firm foundation in human biology is required. The minimum average grade required is the Norwegian "C".

International applicants need to submit proof of English proficiency (TOEFL, IELTS, APIEL or University of Cambridge test). More details about the language requirements are available at www.ntnu.edu/studies/langcourses/languagerequirements

Applicants who are not citizens of the European Union (EU) or the European Economic Area (EEA) need to provide a financial guarantee to get a residence permit in Norway.

Teaching Methods, Learning Activities and Student Social Activities

In 2010 the new Hearth and Lung Centre opened at Øya campus in Trondheim. In this building students get to work in high-tech laboratory environments side by side with researchers both from NTNU and St. Olav's Hospital.

The teaching includes lectures, colloquiums, problem-based learning (PBL), seminars, demonstrations, practical training, self-tuition, and independent work. During the work with the master's thesis the student will do research in our well-equipped laboratories.

SOMA is the master's students' own social student organization. SOMA har various activities during the semesters, including welcome parties and other activities for new students, excursions, courses and much more. For more information, visit SOMA's blog: http://somantnu.blogspot.com

Compulsory HSE Training

All master's students must participate in compulsory Health, Safety and Environment (HSE) training. This includes a biosafety lecture and a lecture on laboratory safety and conduct. When these activities have been completed, the student must pass an electronic test. This is to be done by 15 September 2014. If the student fails to do so, the access card to the campus/hospital buildings will be withdrawn.

Programme Structure

The master's degree is a two-year, full-time programme starting in the autumn semester. There are two main components:

- Theoretical and methodological courses (totalling 60 credits)
- Master's thesis (60 credits)

<table>
<tr><th colspan="2">Year 1</th><th colspan="2">Year 2</th></tr>
<tr><td>1st semester
(autumn)</td><td>2nd semester
(spring)</td><td>3rd semester
(autumn)</td><td>4th semester
(spring)</td></tr>
<tr><td>KLH3100
Introduction to Medical Statistics
(7.5 credits)</td><td>EiT
Experts in Teamwork
(7.5 credits)</td><td colspan="2" rowspan="4">SPO3900
Thesis in Exercise Physiology
(60 credits)</td></tr>
<tr><td>SPO3020
Training Circulation and Oxygen Consumption
(7.5 credits)</td><td>SPO3040
Environmental Adaptations
(7.5 credits)</td></tr>
<tr><td>SPO3030
Training Muscle and Force Production
(7.5 credits)</td><td rowspan="2">SPO3060
Specialisation in Exercise Physiology
(15 credits)</td></tr>
<tr><td>SPO3055
Research Methods in Exercise Physiology
(7.5 credits)</td></tr>
</table>

The first semester is primarily based on theory and lectures. From the second semester most attention is directed towards preparing for carrying out an experiment representing work at the forefront of the research in exercise physiology in close co-operation with the professors in the research group.

Experts in Teamwork (EiT) is compulsory for all master's degree students at NTNU, and it is taught intensively in the weeks 2, 3 and 4 in the second semester. Read more about EiT here: http://www.ntnu.edu/eit

By the end of the first semester, the student must choose a topic for the thesis. A master's thesis agreement (including a project description) is drawn up by the student and submitted to the programme board within the first academic year. More information is available at www.ntnu.edu/dmf/studies/master (in English) / www.ntnu.no/dmf/studier/master (in Norwegian).

The student must have passed all theoretical and methodological courses before he/she can submit the thesis.

Course Descriptions

Year 1

KLH3100	**Introduction to Medical Statistics**
Credits:	7.5
Period:	Autumn
Teaching methods:	Lectures and exercises. Approved exercises from the same or previous semesters are required to sit for the exam. Approved compulsory activities are valid for three subsequent semesters after approval.
Required previous knowledge:	The course is primarily intended for students admitted to a 2-year master's programme at the Faculty of Medicine, NTNU. Other students may be accepted after an individual evaluation.
Compulsory activitiy:	Exercise assignments
Mode of assessment:	4-hour written examination Letter grades (A-F)
Credit reductions due to overlapping courses:	HLS3550: 7.5 credits KLH3004: 7.5 credits KLMED8004: 5.0 credits MNFSIB1: 7.5 credits ST3000: 7.5 credits ST3001: 7.5 credits
Host department:	Department of Cancer Research and Molecular Medicine
Course coordinator:	Associate Professor Turid Follestad

Learning outcome

After completing the course KLH3100, the student is able to:

- choose suitable descriptive measures for presenting data for continuous and categorical variables in an empirical dataset (measures of central location and spread, frequencies, graphical methods);
- apply and understand some theoretical aspects of statistical methods for comparing mean values and proportions in two samples, methods for evaluating linear associations between two continuous variables, and methods for evaluating agreement in repeated measures;
- perform the practical work with statistical analyses by means of a statistical software package;
- describe and interpret results from statistical analyses of empirical data;
- critically evaluate validity of results in view of assumptions on chosen statistical method.

Academic content

- Introduction to the statistical software package SPSS.
- Descriptive statistic for continuous and categorical variables (measures of location and spread, frequency tables, graphical display), probability and probability distributions, estimation, hypothesis testing, one- and two-sample tests on mean values (Student T-test), non-parametric

tests (Wilcoxon signed-rank test and Mann-Whitney U test), tests on differences in proportions (cross-table analysis; chi-square test and McNemar's test, Fisher's exact test), correlation and simple linear regression, methods for assessing agreement (Kappa coefficient, Bland-Altman plot).

SPO3020	**Training Circulation and Oxygen Consumption**
Credits:	7.5
Period:	Autumn
Teaching methods:	Lectures, laboratory work, PBL. Approved practice report and written report. The timetable is available at https://timeplan.medisin.ntnu.no/timetable_show.php
Entry requirements:	Admission to MSc in Exercise Physiology and Sport Sciences
Compulsory activities:	1. Written report 2. Approved practice report
Mode of assessment:	4-hour written examination Letter grades (A-F)
Host department:	Department of Circulation and Medical Imaging
Course coordinator:	Professor Jan Helgerud

Learning outcome

After completing the course SPO3020 the student is able to:

- demonstrate in depth insight into limitations for oxygen transport and effective training regimes for improved circulation and aerobic endurance performance and have practical skills relevant for the field;
- describe biological adaptations as a result of physical activity and exercise training on the heart, arteries and skeletal muscles in our bodies both for health and performance;
- identify and describe the supply and demand limitations for the oxygen transport and utilization in athletes and patients;
- identify and prescribe effective endurance training programs, and to study their effect on top sports performance;
- understand and describe the beneficial effects of endurance training for successful aging and disease prevention, and prescribe effective training programs for treatment;
- apply and adopt experimental methods such as maximal oxygen uptake, lactate threshold and work economy and have practical skills relevant to perform the tests;
- present outcomes of research in a written report, evaluate and discuss scientific results in English.

Academic content

Circulatory function, supply and demand limitations of oxygen to working muscle. Limitations and adaptations in patients and athletes. Training methods and their application to various limitations.

SPO3030	Training Muscle and Force Production
Credits:	7.5
Period:	Autumn
Teaching methods:	Lectures, laboratory work, PBL. Approved practice report and written report. The timetable is available at https://timeplan.medisin.ntnu.no/timetable_show.php
Entry requirements:	Admission to MSc in Exercise Physiology and Sport Sciences
Compulsory activities:	1. Written report 2. Approved practice report
Mode of assessment:	4-hour written examination Letter grades (A-F)
Host department:	Department of Circulation and Medical Imaging
Course coordinator:	Associate Professor Eivind Wang

Learning outcome

After completing the course SPO3030 the student is able to:

- demonstrate in depth insight into limitations for muscular force and effective training regimes for improved muscular function and coordination and have practical skills relevant for the field;
- describe biological adaptations as a result of physical activity and exercise training on the neuromuscular system in our bodies both for health and performance;
- describe muscle architecture and differences in the population;
- identify and prescribe effective strength training programs, and to study their effect on top sports performance both for neural adaptations and protein synthesis;
- understand and describe the beneficial effects of strength training for successful aging and disease prevention, and prescribe effective training programs for treatment;
- apply and adopt experimental methods such as one-repetition maximum, peak force, rate of force development and have practical skills relevant to perform the tests;
- present outcomes of research in a written report, evaluate and discuss scientific results in English Insight into limitations for muscular force and effective training regimes for improved muscular function and its effect on muscular as well as circulatory performance.

Academic content

Muscle architecture and differences in the population. Changes related to age and diseases. Limitations and functional adaptations in patients and athletes. Training methods for neural adaptations and protein synthesis. Neuromuscular basis for motor skill acquisition.

SPO3040	Environmental Adaptions
Credits:	7.5
Period:	Spring
Teaching methods:	Lectures, approved written report. The timetable is available at https://timeplan.medisin.ntnu.no/timetable_show.php
Entry requirements:	Admission to MSc in Exercise Physiology and Sport Sciences
Compulsory activity:	Written report
Mode of assessment:	4-hour written examination Letter grades (A-F)
Host department:	Department of Circulation and Medical Imaging
Course coordinator:	Professor Ulrik Wisløff

Learning outcome

After completing the course SPO3040 the student is able to:

- demonstrate in depth insight into temperature regulation at rest and during exercise at different ambient temperatures;
- describe biological processes during scuba diving and diving in space and how those processes may be regulated by both chronic and acute exercise;
- describe the physiological process of acclimatization to high altitude and understand various treatments strategies for high altitude sickness;
- describe the physiological challenges with exercise training at high altitude;
- describe nutritional requirements for human performance in various environments;
- knowing basic physiological impact from environmental stressors such as hyperoxia, hypoxia, high and low temperatures and how to cope with them in an exercise physiology setting.

Academic content

Cardiovascular and functional responses to a changed environment, such as cold environment / hypothermia,diving,high altitude and space. Acute and chronic responses and adaptation to training in various environments. Nutrition and performance in a changed environment.

SPO3055	**Research Methods in Exercise Physiology**
Credits:	7.5
Period:	Autumn
Teaching methods:	Lectures, PBL, laboratory work, tutoring. Approved practice report and written report. The timetable is available at https://timeplan.medisin.ntnu.no/timetable_show.php
Entry requirements:	Admission to MSc in Exercise Physiology and Sport Sciences
Compulsory activities:	1. Written report 2. Approved practice report
Mode of assessment:	1-week home examination Letter grades (A-F)
Credit reduction due to overlapping courses :	SPO3050: 7.5 credits
Host department:	Department of Circulation and Medical Imaging
Course coordinator:	Professor Ulrik Wisløff

Learning outcome

After completing the course SPO3055 the student is able to:

- know the nature of research - unscientific vs. scientific;
- ethical aspects in research
- demonstrate in depth insight into different medical research designs (RCT, epidemiology, experimental studies)
- plan, design and apply for a research project to the Regional Ethical Committee
- know in detail external and internal threats when designing studies as well as during the interpretations of data (reliability/validity)
- critical review of literature and presentation of studies, evaluate and discuss scientific results in English.
- practice in scientific writing and writing a review
- requirement of scientific evidence before it can be implemented into clinical practice

Academic content

How to perform high quality physiological and medical research.

SPO3060	Specialisation in Exercise Physiology
Credits:	15
Period:	Spring
Teaching methods:	Lectures, tutoring. The timetable is available at https://timeplan.medisin.ntnu.no/timetable_show.php
Entry requirements:	Admission to MSc in Exercise Physiology and Sport Sciences
Compulsory activity:	Compulsory literature: A minimum of 30 articles from peer-reviewed scientific journals.
Mode of assessment:	Report Letter grades (A-F)
Host department:	Department of Circulation and Medical Imaging
Course coordinator:	Professor Jan Hoff

Learning outcomes

After completing the course SPO3060 the student is able to:

- demonstrate intimate knowledge of the research forefront in the area of interest for the master's thesis and have practical skills relevant for the field;
- describe biological adaptations as a result of physical activity and exercise training within the area of research planned for the thesis;
- apply and adopt experimental methods within the area of specialisations and have practical skills relevant to perform the tests;
- present outcomes of research in a review article, evaluate and discuss scientific results in English leading to a logical research question for their thesis. Intimate knowledge of the research forefront in the area of interest for the master's thesis.

Academic content

Specialisation within the area of research planned for the thesis. Review of research literature, and writing a review article in the area of specialisation for the thesis leading to a logical research question.

Year 2

SPO3900	Thesis in Exercise Physiology
Credits:	60
Period:	Autumn and spring
Teaching methods:	Tutoring and laboratory work
Required previous knowledge:	Admission to the MSc in Exercise Physiology and Sport Sciences
Mode of assessment:	Thesis and oral presentation/examination. The grade given on the thesis may be adjusted after the oral exam.
Credit reduction due to overlapping courses :	SPO3901:45 credits
Host department:	Department of Circulation and Medical Imaging
Course coordinator:	Associate Professor Eivind Wang

Learning outcome:

After successful defense of the thesis the student is able to:

- carry out and present an experiment that can be developed to quality of an international peer-reviewed paper;
- demonstrate in depth knowledge of the theme built upon the specialisations in SP03060 and have practical skills relevant for the field;
- apply and adopt experimental methods within the area of specialisations and have practical skills relevant to perform the tests;
- present outcomes of research in the thesis as an article with an extended introduction, evaluate and orally present and discuss the results in English;
- Carrying out and presenting av experiment that can be developed to the quality of an international peer reviewed paper.

Academic content

The thesis should be within the area of the research competence among the available supervisors. The theme has to build upon the specialisation in SPO3060, and will be subject to approval by the programme board. The thesis is to be in the format of an article in a peer-reviewed research journal with an extended introduction, and will be subject to external evaluation. The evaluation is based on the thesis and an oral examination where the student presents his/her project (ca 30 min) with discussion. The oral examination is used to adjust the grade of the thesis.

More information is available at www.ntnu.edu/dmf/studies/master (in English) or www.ntnu.no/dmf/studier (in Norwegian).

Molecular Medicine

2-year Master of Science (MSc)

Programme Code: MSMOLMED
Web page: www.ntnu.edu/studies/msmolmed

This programme description is valid for students admitted in the academic year 2014/2015.

Introduction

The field of Molecular Medicine is often referred to as "tomorrow's medicine". It aims to provide a molecular understanding of how normal cellular processes change, fail or are destroyed by disease.

The mapping of the human genome in 2003 was a turning point, and our knowledge and understanding of molecules in living organisms are advancing at a fast rate. Modern technologies such as high-throughput analyses (microarray and proteomics) enable us to study thousands of genes and proteins simultaneously. This provides the foundation for a totally new understanding of biological systems and generates fresh hypotheses about the importance of genes and proteins for different diseases.

The MSc in Molecular Medicine is administered by the Department of Laboratory Medicine, Children's and Women's Health at the Faculty of Medicine.

Learning Outcome

The graduated student should be able to:

- demonstrate a strong background in molecular medicine (i.e. molecular/cell biology relevant to medical applications) and have practical skills relevant for the field;
- describe the organization of the human genome and its functional regulation (i.e. replication, gene expression, genome maintenance, and signal transduction principles);
- describe the impact of genes, inheritance and environment on disease, and understand how normal cellular processes change, fail or are destroyed by disease development, in particular for common diseases such as cancer, diabetes, and heart disease;
- explain principles of molecular diagnostics and advantages/limitations of its applications;
- recognize and explain current strategies and state-of-the-art approaches within functional genomics;
- collect relevant background information about topics within molecular medicine;
- present, evaluate and discuss scientific results in English (orally and in writing);
- reflect on the existence of ethical aspects, sound experimental approaches and scientific thinking.

Target Groups and Admission Requirements

Admission requirements to the MSc in Molecular Medicine is a bachelor's degree (or an equivalent 3-year education) in biology, biomedical science, biotechnology, chemistry or similar, with an average grade of C or higher. A solid background in cell and molecular biology is highly recommended within the bachelor's degree.

International applicants need to submit proof of English proficiency (TOEFL, IELTS, APIEL or University of Cambridge test). More details about the language requirements are available at www.ntnu.edu/studies/langcourses/languagerequirements. Applicants who are not citizens of the European Union (EU) or the European Economic Area (EEA) need to provide a financial guarantee to get a residence permit in Norway.

Teaching Methods, Learning Activities and Student Social Activities

In 2005 the new Laboratory Centre opened at Øya campus in Trondheim. In this building students get to work in high-tech laboratory environments side by side with researchers both from NTNU, Sør-Trøndelag University College and St. Olav's Hospital.

The teaching methods and learning activities include lectures, colloquiums, problem-based learning (PBL), seminars, demonstrations, excursions, practical training, self-tuition, and independent work. During the work with the master's thesis the student will do research in our well-equipped laboratories.

SOMA is the master's students' own social student organization. SOMA har various activities during the semesters, including welcome parties and other activities for new students, excursions, courses and much more. For more information, visit SOMA's blog: http://somantnu.blogspot.com

Compulsory HSE Training

All master's students must participate in compulsory Health, Safety and Environment (HSE) training. This includes a biosafety lecture and a lecture on laboratory safety and conduct. When these activities have been completed, the student must pass an electronic test. This is to be done by 15 September 2014. If the student fails to do so, the access card to the campus/hospital buildings will be withdrawn.

Programme Structure

The MSc is a two-year, full-time programme of study starting in the autumn semester. There are two main components:

- Master's thesis (60 credits)
- Theoretical and methodological courses (totalling 60 credits). Two courses, making up 22.5 credits, are compulsory. The remaining courses, adding up to 37.5 credits, are selected from lists of electives. Ideally, electives should be linked to the topic of the master's thesis.

There are two lists of elective courses (see below). *Two courses* must be selected from 'Electives 1'. The remaining elective courses can be chosen from both 'Electives 1' *and* 'Electives 2'. Additional relevant courses may be taken at NTNU or other educational institutions subject to the approval of the Faculty of Medicine.

A master's thesis agreement, including a project description, must be submitted by 15 March in the second semester. Potential projects will be presented in advance.

Master's Thesis

MOL3901	Thesis in Molecular Medicine	60 credits

Compulsory Courses

MOL3100	Introduction to Molecular Medicine with Project	15 credits	Autumn
EiT[1]	Experts in Teamwork	7.5 credits	Spring

[1] Experts in Teamwork (EiT) is taught intensively in the weeks 2, 3 and 4 in the second semester. Read more about EiT on this webpage: www.ntnu.edu/dmf/studies/eit

Electives 1

BI3016	Molecular Cell Biology	7.5 credits	Autumn
MOL3001	Medical Genetics	7.5 credits	Spring
MOL3005	Immunology	7.5 credits	Autumn
MOL3007	Functional Genomics	7.5 credits	Spring
MOL3008[2]	Analytical Techniques and Instrumentation	7.5 credits	Spring
MOL3019	Applied Bioinformatics	7.5 credits	Spring

Electives 2

BI3013[3]	Experimental Cell and Molecular Biology	7.5 credits	Autumn
BI3018	Patenting and Commercialization of Biotech and Medtech Inventions	7.5 credits	Spring
BT3103[4]	Molecular Mechanisms of Toxicology	7.5 credits	Autumn
KLH3100	Introduction to Medical Statistics	7.5 credits	Autumn
MOL3003[5]	Molecular Medical Microbiology	7.5 credits	Autumn
MOL3009	Biobanking	7.5 credits	Autumn
MOL3010	Animal Cell Culture	7.5 credits	Autumn
MOL3014	Nanomedicine I – Bioanalysis	7.5 credits	Autumn
MOL3015	Nanomedicine II – Therapy	7.5 credits	Spring
MOL3018	Medical Toxicology	7.5 credits	Spring
MOL3020	Virology	7.5 credits	Spring
NEVR8014	Laboratory Animal Science for Researchers	7.5 credits	Autumn

Some of the elective 2 courses may be cancelled if few students register for the examination.

Model of the MSc Programme (Example)

<table>
<tr><th colspan="2">Year 1</th><th colspan="2">Year 2</th></tr>
<tr><td>1st semester (autumn)</td><td>2nd semester (spring)</td><td>3rd semester (autumn)</td><td>4th semester (spring)</td></tr>
<tr><td rowspan="2">Introduction to Molecular Medicine with Project</td><td>Experts in Teamwork</td><td colspan="2" rowspan="4">Thesis in
Molecular Medicine</td></tr>
<tr><td>Elective course</td></tr>
<tr><td>Elective course</td><td>Elective course</td></tr>
<tr><td>Elective course</td><td>Elective course</td></tr>
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Please note that this is only a suggestion. The student can choose to start with the thesis already in the first year and postpone one or more of the elective courses to the second year.

[2] The course will not be taught if less than 12 students register for the examination. If you intend to take the course, we kindly ask you to register early (preferably by 1 February 2015).
[3] The course has restricted admission, and will be open for master's students in Molecular Medicine only if there are any available seats. Please contact the Department of Biology if you are interested.
[4] The course is taught every second year. It will be given in the autumn semester of 2015, but not in the autumn semester of 2014.
[5] The course has restricted admission. Two-thirds of the seats are reserved for the first-year master's students in Molecular Medicine. One-third of the seats are reserved for second-year master's students in Molecular Medicine and other master's students at NTNU.

The student must have passed all examinations in compulsory and elective courses before he/she can submit the thesis.

Course Descriptions

Courses offered by the Faculty of Medicine

KLH3100	**Introduction to Medical Statistics**
Credits:	7.5
Period:	Autumn
Teaching methods:	Lectures and exercises. Approved exercises from the same or previous semesters are required to sit for the exam. Approved compulsory activities are valid for three subsequent semesters after approval.
Required previous knowledge:	The course is primarily intended for students admitted to a 2-year master's programme at the Faculty of Medicine, NTNU. Other students may be accepted after an individual evaluation.
Compulsory activitiy:	Exercise assignments
Mode of assessment:	4-hour written examination Letter grades (A-F)
Credit reductions due to overlapping courses:	HLS3550: 7.5 credits KLH3004: 7.5 credits KLMED8004: 5.0 credits MNFSIB1: 7.5 credits ST3000: 7.5 credits ST3001: 7.5 credits
Host department:	Department of Cancer Research and Molecular Medicine
Course coordinator:	Associate Professor Turid Follestad

Learning outcome

After completing the course KLH3100, the student is able to:

- choose suitable descriptive measures for presenting data for continuous and categorical variables in an empirical dataset (measures of central location and spread, frequencies, graphical methods);
- apply and understand some theoretical aspects of statistical methods for comparing mean values and proportions in two samples, methods for evaluating linear associations between two continuous variables, and methods for evaluating agreement in repeated measures;
- perform the practical work with statistical analyses by means of a statistical software package;
- describe and interpret results from statistical analyses of empirical data;
- critically evaluate validity of results in view of assumptions on chosen statistical method.

Academic content

- Introduction to the statistical software package SPSS.
- Descriptive statistic for continuous and categorical variables (measures of location and spread, frequency tables, graphical display), probability and probability distributions, estimation, hypothesis testing, one- and two-sample tests on mean values (Student T-test), non-parametric tests (Wilcoxon signed-rank test and Mann-Whitney U test), tests on differences in proportions (cross-table analysis; chi-square test and McNemar’s test, Fisher’s exact test), correlation and simple linear regression, methods for assessing agreement (Kappa coefficient, Bland-Altman plot).

MOL3001	**Medical Genetics**
Credits:	7.5
Period:	Spring
Teaching methods:	Lectures, student presentations, laboratory course and alternative methods of teaching. The lectures and the exam will be in English. If few candidates, alternative exam arrangements may be used. Timetable: https://timeplan.medisin.ntnu.no/timetable_show.php
Recommended previous knowledge:	Biochemistry and basic genetics
Compulsory activities:	Laboratory course
Mode of assessment:	4-hour written examination Letter grades (A-F)
Host department:	Department of Laboratory Medicine, Children's and Women's Health
Course coordinator:	Associate Professor Wenche Sjursen

Learning outcome

After completing the course MOL3001 the student is able to:

- describe central examples of monogenic, polygenic and chromosomal disorders;
- recognise patterns of mendelian inheritance of monogenic diseases, and explain genetic and biochemical mechanisms of some central monogenic disorders;
- describe and understand mechanisms underlying numerical and structural chromosomal aberrations and principles mediating chromosomal disease;
- describe what genetic counselling and risk assessment are, and how genetic counselling is regulated by law in Norway;
- describe and understand central principles and examples in cancer genetics, including sporadic and hereditary cancers;
- describe and understand principles for methods of genetic diagnosis, i.e. gene tests and cytogenetic methods;
- describe and understand principles and methods for gene mapping - calculate frequencies of genetic variants at individual and population based level.

Academic content

The course will give an overview of mechanisms for development of genetic diseases. Topics include different patterns of inheritance, like dominant, recessive, autosomal and sex linked inheritance. Genetic diseases will be classified in single-gene, chromosomal and multifactorial disorders. It will be discussed how identification of genes and variants in the genome, including gene mapping, make it possible to understand how variation can lead to disease.

MOL3003	**Molecular Medical Microbiology**
Credits:	7.5
Period:	Autumn
Teaching methods:	Lectures, seminars, laboratory exercises, a compulsory written assignment (which counts 30% of the final grade) and demonstrations. The language of teaching and examination is English. Timetables for courses at the Faculty of Medicine are available at https://timeplan.medisin.ntnu.no/timetable_show.php
Recommended previous knowledge:	Basic knowledge in microbiology, cell biology, biochemistry, and molecular biology
Compulsory activities:	Guided self study, including laboratory work
Mode of assessment:	Oral examination – 70 % of the final grade Written assignment – 30 % of the final grade Letter grades (A-F)
Host department:	Department of Laboratory Medicine, Children's and Women's Health
Course coordinator:	Associate professor Jan Egil Afset

The course has restricted admission. Two-thirds of the seats are reserved for first-year master's students in molecular medicine. One-third of the seats are reserved for second-year master's students in molecular medicine and other master's students at NTNU.

Learning outcome

After completing the course MOL3003 the student is able to:

- demonstrate a strong general knowledge in molecular medical microbiology;
- have good knowledge of the PCR method including design, optimization and validation for detection, identification and quantification of microorganisms, and be able to interpret PCR results and discuss limitations of the method;
- demonstrate basic skills in performing PCR in the laboratory;
- discuss interpretation of PCR results and limitations of the method;
- demonstrate knowledge of other molecular methods for identification and quantification of microorganisms;
- demonstrate good knowledge of molecular methods for genotyping of microbial agents, and discuss the use of molecular epidemiological methods in the investigation of infectious diseases;
- describe the use of bioinformatics tools in molecular medical microbiology, and should have basic skills in the use of such methods;
- describe and discuss the use of relevant quality control measures in the molecular medical microbiology laboratory.

Academic content

The intention of the course is to introduce the student to the use of molecular genetic methods in the detection and characterisation of microorganisms. Methods for extraction methods, qualitative and quantitative PCR methods and DNA sequencing will be presented. The students will also be introduced to the principles for primer and probe design. The use of databases will be the subject of lectures, and the use of databases aiming at establishing molecular genetic assays. The application of genotypic assays for the purpose of molecular epidemiology will be discussed and demonstrated.

MOL3005	**Immunology**
Credits:	7.5
Period:	Autumn
Teaching methods:	Lectures and colloquiums (not compulsory). The language of teaching is English. Timetable: https://timeplan.medisin.ntnu.no/timetable_show.php Information will be communicated on It's learning.
Recommended previous knowledge:	Basic knowledge within cell biology and biochemistry/molecular biology.
Mode of assessment:	4-hour written examination Letter grades (A-F)
Credit reductions due to overlapping courses:	BI2013: 7.5 credits MNKBI213: 7.5 credits
Host department:	Department of Laboratory Medicine, Children's and Women's Health
Course coordinator:	Post Doctor Ingvild Bjellmo Johnsen

Learning outcome

After completing the course MOL3005 the student is able to:

- demonstrate the basic knowledge of immunological processes at a cellular and molecular level;
- define central immunological principles and concepts;
- outline, compare and contrast the key mechanisms and cellular players of innate and adaptive immunity and how they relate;
- understand the principles of central (antibody-based) immunological methods to an extent that he/she can set up a theoretical experiment;
- elucidate the genetic basis for immunological diversity and the generation of adaptive immune responses;
- outline key events and cellular players in antigen presentation, and how the nature of the antigen will shape resulting effector responses;
- identify the main mechanisms of inflammation;
- understand the principles governing vaccination and the mechanisms of protection against disease;
- understand how immunodeficiencies related to disease;
- understand and explain the basis of allergy and allergic diseases.

Academic content

The immune system governs defense against pathogens and is of importance for development of autoimmune diseases, allergy and cancer. The course discusses basic immunology including cellular and molecular processes that represents the human immune system. Subjects to be presented include cells and organs of the immune system, antigen, immunoglobulins and antibody diversity, molecular mechanisms of innate and adaptive immunity, the complement system, antigen presentation, cell-mediated effector responses, immunological techniques and select lecture on the immune system in health and disease.

MOL3007	**Functional Genomics**
Credits:	7.5
Period:	Spring
Teaching methods:	Lectures, laboratory course. The lectures are held in the spring semester, and starts in early February. The language of instruction and examination is English. Timetable: https://timeplan.medisin.ntnu.no/timetable_show.php
Recommended previous knowledge:	Basic skills in molecular biology and physiology.
Compulsory activity:	Laboratory course
Mode of assessment:	4-hour written examination Letter grades (A-F)
Host department:	Department of Cancer Research and Molecular Medicine
Course coordinator:	Professor Astrid Lægreid

Learning outcome

After completing the course MOL3007 the student is able to:

- describe what is meant by functional genomics and how this area of research contributes both to new basic biomedical knowledge and to new developments in molecular medicine, including improved diagnostics and treatment of diseases;
- understand the interdependence of biomedicine, bioinformatics and bioethics within this field of research - reflect on ethical and societal aspects of functional genomics translated to health care;
- explain how genetically modified organisms can contribute basic biomedicine and to molecular medicine;
- explain main principles of high throughput analysis of gene expression and gene function by microarray and sequencing;
- explain the concepts of structural motifs and domains in proteins and methods used to assess these structures;
- explain main principles of some methods used in separation of protein;
- explain main methods for inonisation of peptides and how mass analysis of peptides and fragments thereof can be used to identify proteins and their post-translational modifications;
- explain main principles of bioinformatic tools used for data analysis, biological background knowledge management and modelling.

Academic content

- Fundamental principles within functional genomics, emphasizing the transcriptome and the proteome.
- Hypothesis generation/experimental design.
- Microarray-technology.
- HTP sequenching technology.
- Structure biology.
- Experimental model systems.
- Heterologous expression.
- Imaging.
- MicroRNA and manipulation of gene expression by RNA interference.
- Protein separation (2D-PAGE, 2D-LC).
- Mass spectrometry (MALDI-TOF, ESI-MS).
- Protein structure analysis (X-ray chrystallography, NMR).
- Ethical perspectives within functional genomics and genetic risk information.

MOL3008	Analytical Techniques and Instrumentation
Credits:	7.5
Period:	Spring
Teaching methods:	Lectures and laboratory course. The course is offered by the Department of Technology at Sør-Trøndelag University College (HiST). Lecturers are Liv Thommesen, Geir Bjørkøy, Randi Utne Holt, Eli Kjøbli and Ragnhild Bach.
Compulsory activity:	Laboratory course
Mode of assessment:	4-hour written examination Letter grades (A-F)
Host institution:	Sør-Trøndelag University College
Course coordinator:	Professor Liv Thommesen

The course will not be taught if less than 12 students register for the examination. If you intend to take the course, we kindly ask you to register early (preferably by 1 February 2015).

Learning outcome

After completing the course MOL3008 the student is able to:

- explain the basic principles of analyses and detection systems involved in photometric-, fluorometric- and luminescence-based methods;
- explain principles of electrophoresis and immunochemical techniques and discuss how these techniques can be used in molecular medicine;
- discuss the use of enzyme kinetics in analytical methods;
- explain basic principles for chromatographic separation techniques;
- discuss quality control, error sources, documentation and storage of experimental data

Academic content

- Introduction to main principles of analyses and detections system
- Optical techniques, chromatography, electrochemistry and chemical sensors, immunochemical techniques, measurement of enzymatic activity
- Automation in clinical laboratory
- Quality control
- Evaluation of methods

MOL3009	Biobanking
Credits:	7.5
Period:	Autumn
Teaching methods:	Lectures, seminar, group exercises, laboratory exercise, excursion, semester project. The language of teaching and examination is English. If few students sign up, the course may be cancelled. If the nubmber of students exceed a given number, alternative examintaion might be considered. Timetables for courses at the Faculty of Medicine are available at https://timeplan.medisin.ntnu.no/timetable_show.php
Recommended previous knowledge:	Basic knowledge in medical genetics and cell biology
Compulsory activities:	Excursion, laboratory exercise and project work
Mode of assessment:	Oral examination Letter grades (A-F)
Host department:	Department of Laboratory Medicine, Children's and Women's Health
Course coordinators:	Professor Jostein Halgunset

Learning outcome

After completing the course MOL3009 the student is able to:

- describe and explain universal and special features of the different types of biobanks;
- explain the different conditions and requirements that must be fulfilled with regard to operation and use of research biobanks;
- describe quality management, quality assurance, logistics and data management related to biobanks;
- discuss ethical issues and policy guidance regarding research involving human biological materials;
- outline the main features of laws and other directives which are relevant for biobanking;
- discuss the use and the potential utility values of biobanks;
- outline how to establish and operate a biobank;
- describe in detail the application process for the establishment of a research biobank - sketch the plan for a research project using human biological material.

Academic content

This course will focus on the following topics:

- Biobanks: classifications, common and distinctive features of the different types of biobanks.
- National regulations and international conventions concerning biobanks, use of human biological materials and personal data.
- Research biobanks: formal and practical aspects of the establishment, operation and use
- Ethical aspects of utilization of human biological materials; The role of Research Ethics Committees
- Different types of consent as basis for biobanking; alternatives to consent
- Logistics and quality management; quality assurance and quality control of collection, storage , retrieval and use of samples
- Methods for analysis of human biological materials; assessment and interpretation of data
- Extraction and quality assessment of DNA and/or RNA from various sources
- Collection and storage of data; databases and data security
- Statistical and epidemiological methods in biobank related research
- The role of biobanks in health surveys like HUNT, Mother-Child etc.
- Research for the future: National and transnational genetic and epidemiological research collaboration

MOL3010	**Animal Cell Culture**
Credits:	7.5
Period:	Autumn
Teaching methods:	Self-tuition. The language of the examination is English.
Recommended previous knowledge:	Basic knowledge in cell biology and biochemistry. One should have some experience with cell culture work.
Mode of assessment:	Oral examination Letter grades (A-F)
Host department:	Department of Laboratory Medicine, Children's and Women's Health
Course coordinator:	Post Doctor Jostein Malmo

Please note that this course is based on self-tuition. It will not be given any lectures.

Learning outcome

After completing the course MOL3010 the student is able to:

- demonstrate knowledge of basic cell culture techniques;
- demonstrate knowledge of establishment of cell inlines and their maintenance;
- demonstrate knowledge on design and use the cell culture facilities;

- critically evaluate cell cultures constraints and possibilities as an in vitro model;
- discuss the advantages and limitations of primary cell culture compared to immortalized or transformed cell lines.

Academic content

The course will focus on practical aspects of cell culture, like design and layout of the laboratory, aseptic technique, cloning and selection of specific cell types, contamination, methods for measuring viability and cytotoxicity, cell culture environment (substrate, gas phase, medium) and the culturing of specific cell types.

MOL3014	**Nanomedicine I - Bioanalysis**
Credits:	7.5
Period:	Autumn
Teaching methods:	The syllabus of the course is defined by the learning objectives. The course is based on lectures given by experienced researchers within each theme. The course includes a compulsory project providing an in-depth review of the primary litterature, which will account for 25 % of the final grade. There might be simple lab exercises dependent on number of students enrolled. The language of instruction is English. Timetable: https://timeplan.medisin.ntnu.no/timetable_show.php
Recommended previous knowledge:	Basic skills in molecular biology, cell biology, chemistry, physics. Most suited for students who have completed courses in basic molecular and cell biology.
Mode of assessment:	4-hour written examination – 75 % of the final grade Exercise / Project – 25 % of the final grade Letter grades (A-F)
Host department:	Department of Cancer Research and Molecular Medicine
Course coordinator:	Professor Øyvind Halaas

Learning outcome

After completing the course MOL3014 the student is able to:

- understand how nanotechnology can be tailored and used for biomedical purposes;
- understand the problems and possibilities for analysis of proteins, nucleic acids and cells by micro fabricated devices and nanotechnological solutions;
- outline fabrication procedures and general considerations for microfluidics;
- understand how nano-relevant instruments such as focused ion beam scanning electron microscopes, atomic force microscopes and optical microscopes can be used in biomedicine;
- perform simple micro fabrication procedure;
- find, refer and consider relevant information.

Academic content

This course will cover fundamentals of bioanalysis and module integration for applications. In detail the course will contain:

- Advanced protein and DNA chemistry.
- Methods for quantification and identification of DNA/RNA and protein with focus on technical principles and emerging nanotechnologies.
- Use of imaging in nanoscale for biomedical research.
- Microfluidics.
- Principles for and contruction of lab-on-a-chip and biosensors.
- Nanoneuroscience.

This course is focused on technology rather than biology.

MOL3015	**Nanomedicine II - Therapy**
Credits:	7,5
Period:	Spring
Teaching methods:	The syllabus of the course is defined by the learning objectives. The course is based on lectures given by experienced researchers within each theme. The course includes a compulsory project providing an in-depth review of the primary litterature, which will account for 25 % of the final grade. The language of instruction is English. The lectures are held in the spring semester and start in early February. Timetable: https://timeplan.medisin.ntnu.no/timetable_show.php
Recommended previous knowledge:	Basic skills in molecular biology.
Mode of assessment:	4-hour written examination – 75 % of the final grade Exercise / Project – 25 % of the final grade Letter grades (A-F)
Host department:	Department of Cancer Research and Molecular Medicine
Course coordinator:	Professor Øyvind Halaas

Learning outcome

After completing the course MOL3015 the student is able to:

- understand how nanotechnological approaches can be used in biomedical therapies;
- understand biomaterials and interaction of biomaterials with cells, body fluids and tissues;
- understand basic stem cell biology and corresponding requirement for tissue engineering;
- understand the need, obstacles and solutions for polymeric, lipidous and solid nanosized drug delivery systems;
- understand the toxicological aspects of nanosized surfaces and particles;
- find, refer and evaluate available information.

Academic content

The course will introduce use of nanotechnology in therapy. In detail, the course will cover

- Clinical biomaterials, tissue regeneration, including stem cell technology, immunological limitations and encapsulation strategies.
- Methods and possibilities for drug discovery.
- Use and design of nanoparticles for gene therapy, drug delivery and drug targeting.
- Physiological, cellular and toxicological limitations for medical use of nanoparticles.
- Theranostics, the combined use of in vivo imaging/diagnostics and therapy.
- Ethical, legal and social aspects (ELSA) related to use of medical nanotechnology will be discussed.

A written report is included, where the student will choose a theme from the lectures, review the literature, describe current methods, consider and recommend use of emerging nanotechnologies in a therapeutic setting.

MOL3018	Medical Toxicology
Credits:	7.5
Period:	Spring
Teaching methods:	Lectures. The language of instruction and examination is English. The course is taught in the spring semester, and starts in late January or early February. Timetable: https://timeplan.medisin.ntnu.no/timetable_show.php
Recommended previous knowledge:	Passed examinations in BI1001 and BI1004, or TBT4100 and TBT4105 (or similar courses).
Required previous knowledge:	Basic knowledge of physiology, chemistry, biochemistry and mathematics.
Mode of assessment:	4-hour written examination Letter grades (A-F)
Credit reductions due to overlapping courses:	TOKS1010: 7.5 credits TOKS3010: 7.5 credits
Host department:	Department of Cancer Research and Molecular Medicine
Course coordinator:	Associate Professor Bent Håvard Hellum

Learning outcome

After completing the course MOL3018, the student is able to:

- describe and explain toxicological mechanisms;
- perform simple analysis of how some chemicals might be a possible health hazard upon exposure;
- explain how certain xenibiotics in the environment and work can have toxic effects on central organs and organ systems in humans;
- collect relevant background data regarding toxicologial problems.

Academic content

The course gives an introduction to general pharmacokinetic models. Liver, kidney, lung, the immuno- and nervous system will be discussed as target organs for chemical toxicity. Groups of toxic agents and substances of abuse will also be included. Major weight will be put on available methods for risk assessment of human expose to cancer and non-cancer agents.

MOL3019	Applied Bioinformatics
Credits:	7.5
Period:	Spring
Teaching methods:	Lectures and exercises (in computer lab). The lectures are given in the spring semester and start late January / early February. The exam in the spring semester is written, whereas exam in the autumn semester will be oral. The language of instruction and exam is English. Timetable: https://timeplan.medisin.ntnu.no/timetable_show.php
Recommended previous knowledge:	Basic knowledge in molecular biology, statistics and informatics.
Compulsory activity:	Exercises
Mode of assessment:	4-hour written examination Letter grades (A-F)
Credit reduction due to overlapping course:	MTEK3001: 7.5 credits
Host department:	Department of Cancer Research and Molecular Medicine
Course coordinator:	Professor Finn Drabløs

Learning outcome

After completing the course MOL3019 the student is able to:

- explain the main principles of important algorithms and methods used in bioinformatics tools, including dynamic programming, hidden Markov models and neural networks;
- explain function and use of important bioinformatic tools, in particular tools for sequence level analyses (genome, gene, RNA, protein);
- describe important formats for storage and exchange of bioinformatic data;
- describe content and use of important bioinformatic databases and web portals;
- describe the use of bioinformatic tools and databases as a basis for systems biology;
- use bioinformatic tools and databases to analyse relevant data from molecular biology.

Academic content

The course aims at providing an introduction to the use of important methods in bioinformatics, including sequence library searches, pair wise and multiple alignment, phylogenetic analysis, gene prediction and structure prediction. The usage of these methods is also discussed in a systems biology context, and ontologies, large scale analysis and studies of complex systems will be discussed. The students will be able to test the methods on realistic problems through PC-based exercises. There will be emphasis on using an interdisciplinary approach during presentations and exercises, in order to make the course accessible to students in informatics as well as medicine and molecular biology.

MOL3020	**Virology**
Credits:	7.5
Period:	Spring
Teaching methods:	Lectures and alternative methods of teaching. Teaching and exam will be in English. If few candidates sign up alternative examination may be considered and used. Timetables for courses at the Faculty of Medicine are available at https://timeplan.medisin.ntnu.no/timetable_show.php
Recommended previous knowledge:	Knowledge in microbiology, cell biology, biochemistry, and molecular biology
Mode of assessment:	4-hour written examination Letter grades (A-F)
Host department:	Department of Laboratory Medicine, Children's and Womens Health
Course coordinator:	Professor Marit Walbye Anthonsen

Learning outcome

After completing the course MOL3020, the student is able to:

- demonstrate a general knowledge in molecular virology;
- describe elements of the viral life cycle;
- explain viral replication strategies;
- describe viral recognition mechanisms and immunological defense responses;
- discuss principles of virus pathogenesis;
- outline viral molecular epidemiology;
- explain vaccine strategies and mechanisms of antiviral drugs.

Academic content

The course will give an overview of medically important virus families, their replication strategies and mechanisms for development of viral infectious diseases. Topics will include taxonomy, replication strategies, pathogenicity and transmission of viruses and, additionally, diagnosis, prevention and treatment of viral diseases. Antiviral immunity and viral immuno-evasion will also be covered. Common human viral infections will be the main focus of the course, and emphasis will be put on virus-host interactions as a key to understanding the diversity of viruses and viral diseases.

MOL3100	Introduction to Molecular Medicine with Project
Credits:	15
Period:	Autumn
Teaching methods:	The curriculum of the course is defined by learning objectives. Lectures, computer courses (EndNote and Bioinfomatics), study groups and article presentations are included. The course also includes a compulsory project which accounts for 50 % of the final grade. The language of instruction and examination is English. Timetable: https://timeplan.medisin.ntnu.no/timetable_show.php
Required previous knowledge:	Admission to the MSc in Molecular Medicine at NTNU
Compulsory activities:	Article presentation
Mode of assessment:	4-hour written examination – 50 % of the final grade Project – 50 % of the final grade Letter grades (A-F)
Host department:	Department of Cancer Research and Molecular Medicine
Course coordinator:	Researcher Bodil Merete Kavli

Learning outcome

After completing the course MOL3100 the student is able to:

- describe the organization of the human genome and its functional regulation (i.e. replication, gene expression, genome maintenance, and signal transduction principles);
- describe the impact of genes, inheritance and environment on disease;
- understand how normal cellular processes change, fail or are destroyed by disease development, in particular for common diseases such as cancer, diabetes, and heart disease;
- collect relevant background information about topics within molecular medicine, use EndNote, and to write a scientific review article of a given topic in English;
- read and present scientific papers.

Academic content

The lectures will cover the organization and major features of the regulation of the function of the human genome, such as gene expression, replication and genome maintenance. Consequences of mutations and polymorphisms, and impacts of genes and environment on major common diseases, such as cancer, diabetes, vascular and coronary disease, will be covered. Basic principles of extracellular and intracellular signalling systems will also be included. Methods of DNA analysis, gene technology and applied bioinformatics will be discussed.

MOL3901	Thesis in Molecular Medicine
Credits:	60
Teaching method:	Individual supervision
Admission requirements:	The student must be admitted to the Master of Science in Molecular Medicine. In order to be eligible to defend his/her master's thesis the student must have passed all exams, i.e. compulsory and elective courses worth 60 credits in total.
Compulsory activity:	Individual supervision
Form of examination:	Thesis and oral presentation / examination. The grade given on the thesis may be adjusted after the oral examination.
Host department:	Department of Laboratory Medicine, Children’s and Women’s Health
Course coordinator:	Associate Professor Wenche Sjursen

Learning outcomes

After successful defense of the thesis the student is able to:

- formulate a precise research problem;

- scientifically test and answer a research problem;
- prepare and analyze data from a study/experiment - master methods and techniques relevant for the research problem;
- present a research problem and discuss the results critically by use of relevant scientific literature;
- describe a scientific work in a clearly written report (master's thesis);
- present the results, both in writing and orally, with sound language and precise statements.

Academic content

The master's thesis in molecular medicine could have a basal or a medical direction. The thesis should have a scientific composition and be founded on applicable theory and literature within the specific subject.

Current topics could be molecular mechanisms and epidemiological causes, diagnostic problems and therapeutic measures. It is a great advantage that the thesis is connected to the existing research activities at the Faculty of Medicine. The principal supervisor is chosen among the scientific staff with permanent positions.

The thesis should be a monograph or a scientific paper with concluding remarks. In both cases, the student should document a theoretical comprehension and a broad understanding of the methods that have been used. Students enrolled in the master's programme in 2007 or earlier can write the thesis in Norwegian or English. Students enrolled in the master's programme in 2008 or later must write the thesis in English.

Details regulating the work with and assessment of the thesis are given in Guidelines for the Master's Thesis in Molecular Medicine. More information is available at www.ntnu.edu/dmf/studies/master (in English) or www.ntnu.no/dmf/studier/master (in Norwegian).

NEVR8014	**Laboratory Animal Science for Researchers**
Credits:	7.5
Period:	Autumn
Teaching methods:	Lectures, study groups and individual assignments. The course consists of 35 hours of lectures(given in week 47), 24 hours of self-tuition (group work and individual assignments) and 21 hours of practical training. The requirements are set by the Department of Agriculture (http://oslovet.veths.no/Oppl/nye.html#KatC). You must arrange the 3 days of practical training yourself. This is usually done in your own research group. The training must be supervised by a person with FELASA C or B competence. Then the practical training documentation must be signed and approved by the local veterinarian at the laboratory animal facility.
Recommended previous knowledge:	Biomedical education, courses in statistics, knowledge of literature search on the internet and in the library.
Required previous knowledge:	A 3-year education on university or college level is a prerequisite in order for the participant to use the title "FELASA category C, Researcher" when the compulsory activities (see the below) have been carried out. Enrolment in a PhD programme, master programme or at "forskerlinjen" in medicine at NTNU. PhD and "forskerlinje" students at the medical faculties at the universities in Bergen, Oslo and Tromsø are given access according to a mutual agreement between these institutions. Others are referred to the course MDV6003.
Compulsory activities:	Lectures (five days). Individual assignment.
Mode of assessment:	4-hour written examination Passed/not passed
Host department:	Department of Cancer Research and Molecular Medicine
Course coordinator:	Post Doctor Marianne Waldum Furnes

Learning outcome

After completing the course NEVR8014 the student:

- shall know the principles behind modern theory on animal experiments and welfare
- knows the legislature regulating the use of lab animals in Norway
- knows the potential health hazards related to animal experiments, and how to minimize these hazards
- understands the significance of the internal and external factors influencing a lab animal and which thereby may influence the outcome of the experiment
- knows roughly how to monitor the health of lab animals
- understands the most important principles for chosing methods for handling and treating lab animals
- understand the principles behind anaesthesia, analgesia and humane killing of lab animals
- understands the general principles for planning animal experiments, including quality control and know of the potential alternatives and supplements to animal experiments which exist
- is able to evaluate a published article on animal experiments with emphasis on how the animals are described and used and know of and be able to use guidelines for good reporting of animal experiments
- has insight into the most important factors which decide the running of a research department using lab animals and be able to do a simple evaluation of a department
- has an attitude towards the lab animals which reflect "the three R's" with focus on animal protection and animal welfare (Replace, Reduce, Refine).

Academic content

FELASA = Federation of Laboratory Animal Science Associations. We follow their minimum recommendations for education and training for researchers (FELASA C researcher). This means that you most likely can travel with your Diploma (FELASA C) to other European countries and work with Laboratory animals. But other countries might ask for additional training and have more stringent rules. Legislation, Ethics and views in society; the course of events in animal experiments; biology of lab animals; the choice of species; genetical and environmental factors influencing animal experiments; health hazards; principles concerning the handling of animals, anesthesia, analgesia and humane killing of lab animals; evaluation and quality control of animal experiments; reporting; alternatives to animals experiments; literature search. The course is divided into two sections; a general section (3 days) and a selectable section (2 days) where the students can choose between traditional laboratory animals and fish/aquatic organisms. Course participants should select their specialization on the basis of the animals they will work with after the course. Traditional animals specialization: laboratory animals biology, health monitoring, anesthesia and euthanasia, ethology, genetics, transgenic animal models, handling techniques. Fish specialization: Legislation concerning fish, experimental conditions, stress, biorythms and acclimatization, pain and suffering, anesthesia, handling, surgical procedures and euthanasia, aggression and hierarchy formation, health monitoring and microbiological qualities, transgene fish.

Courses offered by the Faculty of Natural Sciences and Technology

BI3013	**Experimental Cell and Molecular Biology**
Credits:	7.5
Period:	Autumn
Teaching methods:	Laboratory course / demonstrations (40 hours, compulsory) Lectures (20 hours, compulsory)
Compulsory activities:	Laboratory course / demonstrations Approved report
Mode of assessment:	4-hour written examination Letter grades (A-F)
Credit reductions due to overlapping courses:	MNKBI313: 7.5 credits
Host department:	Department of Biology
Course coordinator:	Associate Professor Per Winge

BI3013 has restricted admission. Please contact the Department of Biology if you are interested.

Learning outcome

The aim of the course is to introduce basic methods in cell- and molecular biology. The course includes practical exercises in modern experimental techniques and instruments, and also training in literature search and the use of Internet. Selected analytical methods will be presented and tested. The course also includes analyses of problems and artefacts that generally occur in biological samples examined using chemical and biological analyses.

Academic content

On completion of the course students should be familiar with basic methods in cell- and molecular biology. Students should also be able to demonstrate knowledge of how to use modern experimental techniques and instruments.

BI3016	Molecular Cell Biology
Credits:	7.5
Period:	Autumn
Teaching methods:	Lectures (26 hours) and seminars (24 hours, mandatory)
Mode of assessment:	4-hour written examination
Credit reductions due to overlapping courses:	MNKBI316 7.5 credits
Host department:	Department of Biology
Course coordinator:	Associate Professor Per Winge

Learning outcome

On completion of the course students should have an understanding of cell biology mechanisms on a molecular level, and of the regulation of such mechanisms.

Academic content

Subjects covered include: Apoptose/necrose mechanisms; Kinases/phosphatases classification and regulation; Transcription factors, classification and regulation; Lipid mediators, regulation and function mechanisms; DNA repair mechanisms. Syllabus will mainly be based on research- and review articles.

BI3018	Patenting and Commercialization of Biotech and Medtech Inventions
Credits:	7.5
Period:	Spring
Teaching methods:	The course is held intensively during one week during the months March / April. Lectures and case-based work in groups are repeated for every theme in the course. Oral presentation of work in groups by students. Written assignments are to be submitted two/three weeks after completion of the intensive part of the course. These are performed in groups. Submission written project assignment.
Recommended previous knowledge:	Target group: Master's and PhD students, Tech Trans personnel, Biotech/Medtech staff
Required previous knowledge:	Bachelor's degree or equivalent.
Mode of assessment:	Report Letter grades (A-F)
Host department:	Department of Biology
Course coordinator:	Professor Berit Johansen

Learning outcome

Knowledge: The candidate shall have knowledge about:

- aspects involved in tranforming a research project to commersial product
- IP management;
- patenting; basics, process, national/international law, regulations, practising, similarities/differences;
- scientific versus commercial aspects on patenting strategy/IP evaluations;
- processes involved in transforming a research product to a clinical product;
- models for sale of IP, licensing versus sale;
- business development: IP, business plan, coworkers, financing.

Skills: The candidate can:

- identify and describe the different processes important for conservation of intellectual property of an invention and how to commercialize;
- identify and describe criteria and processes for sale of IP, including business development.

General competence: The candidate can:

- identify and explain principles in processes regulating protection and sale of IP.

Academic content

Topics that will be covered in the course include:

- Patenting: Principles, process, national/international laws, regulations and practice, similarities/differences between European and US patenting laws and practise.
- IPR strategies: Scientific/commercial aspects, how to develop an IP strategy to accelerate the innovation process and to safeguard IP investments, mastering freedom to operate in the Biotech/MedTech industry, Patent litigations, infringements and enforcements.
- Licensing: Models and negotiation strategies.
- Clinical testing: Design, implementation, analysis and presentation of clinical trials, adaptive clinical trial designs.
- Bio-tech/Med-tech business development: Strategy and organization when transferring a scientific idea into a commercial product/business, business plan development, product pipeline analysis, market analysis, market potential prediction, alliance structures and negotiation conditions, capital capture (pre-seed, seed, VC).

Target group: master's and PhD students, Tech Trans personnel, Biotech/Medtech staff, university academic staff.

BT3103	**Molecular Mechanisms of Toxicology**
Credits:	7.5
Period:	Autumn
Teaching methods:	Lectures. Intensive course 7-8 weeks Exam: written. In case of few student the written examination can be replaced by an oral examination. The course will be given in English if necessary.
Recommended previous knowledge:	TBT4102 Biochemistry 1, and TBT4145 Molecular Genetics
Mode of assessment:	Report Letter grades (A-F)
Host department:	Department of Biotechnology
Course coordinator:	Professor Aage Haugen

The course is given every second year. It will be taught in the autumn semester of 2015, but not in 2014.

Learning outcome

Enhance the student`s understanding of the harmful interactions between environmental agents and biological targets aiming at molecular mechanisms and pathways underlying these effects.

Academic content

The course gives students an understanding of how cells and organisms respond to chemical agents: xenobiotic metabolism; oxidative stress; inflammation; nuclear receptor-mediated toxicity; DNA damage inflicted by toxic chemicals and carcinogenic compounds; the role of signal transduction systems and gene regulation; cell cycle regulation; DNA repair; apoptotic and necrotic cell death; gene – environment interactions, genetic susceptibility.

Neuroscience

2-year Master of Science (MSc)

Programme code: MSNEUR
Webpage: www.ntnu.edu/studies/msneur

This programme description is valid for students admitted in the academic year 2014/2015.

Introduction

The MSc in Neuroscience provides an in-depth study of brain structure and -function, reaching from the molecular to systems level. A central aim for students is to understand how neural systems may contribute to sensory experiences, thoughts, emotions and behaviour, and learn to adopt experimental methods to gain new knowledge in the field.

The MSc in Neuroscience is an interdisciplinary collaboration between the following faculties:

- Humanities
- Information Technology, Mathematics and Electrical Engineering
- Medicine
- Natural Sciences and Technology
- Social Sciences and Technology Management

The MSc is coordinated by the Programme Board of Neuroscience, with representatives from the students and the participating faculties. It is administered by the Department of Neuroscience at the Faculty of Medicine.

The degree awarded to students completing the programme will be *Master of Science in Neuroscience*. Completion of the master's degree is a qualification for studies at the PhD level.

Learning Outcome

General learning outcome
A solid knowledge about neuroscience, good experimental and theoretical skills, and competence to obtain and critically appraise own and already published experimental and theoretical data and to pursue a career in neuroscience.

Specific learning outcome

Knowledge

- The student has advanced knowledge of the research field of neuroscience including its subareas (Molecular and Cellular neuroscience, Systems Neuroscience (including comparative neuroscience), Computational Neuroscience and Cognitive Neuroscience) and disciplines (Anatomy, Physiology, Biochemistry, in vivo and in vitro Imaging techniques at cellular and network level, neurogenetics, neurophysics).
- The student has knowledge of relevant methodologies and techniques in neuroscience including both historical as well as more recent techniques.
- The student has knowledge about:
    - Sensory systems (somatosensory, visual, auditory, olfactory and taste, vestibular, pain, visual streams, barrel cortex, topographic organization, homunculus)
    - Motor systems (prim motor system, basal ganglia, cerebellum)

    - association cortex (definitions and different levels such as prefrontal, parietal, temporal cortex, etc.)
    - monosynaptic and complex reflex networks at spinal cord and brainstem levels.
- The student has specialized knowledge in at least one of the above mentioned disciplines.
- The student has knowledge about the main current theoretical concepts in Neuroscience, and can apply this to his/her own research: Chemical and electrical signaling, cellular integration, regulation of neuronal activity, excitatory and inhibitory transmission and the related cellular mechanisms (transmitter synthesis, packaging, release, receptor binding, location and regulation of receptor expression). Theorems include cortical networks, hierarchical processing, feedforward and feedback connectivity. Primary and higher order (association) cortex, oscillations and their functions, concepts of neuronal networks. Role of thalamocortical and cortico-basal ganglia networks, default networks, (monoaminergic/subcortical)modulation, and computational models including connectionists models (small world networks, spin glass models) and oscillatory models.
- The student has knowledge about mainstream concepts of neurophilosophy and ethics. The student is aware of and has knowledge of the relevant historical perspectives in neuroscience, its traditions and the position in the society. Is aware of debates in the field on neurophilosophy, theory of mind and discussions on consciousness.

Skills

- The student is capable of analyzing main outstanding issues in neurosciences, follow and analyze ongoing debates in the field, with special knowledge in at least one domain.
- The student knows how to find relevant methods and how to apply those to his/her project/question of interest.
- The student has competence to analyze experimental data, put them in a context of relevant available (published) data in neuroscience and directly adjacent fields such as psychology, and the ethical and societal issues related to neuroscience research and is able to communicate experimental results both orally and in a number of specific written formats.
- The student can analyze existing theories, methods and assumptions within the field of neuroscience.
- The student can recognize and validate problems; formulate and test hypotheses.
- The student can evaluate and formulate a theoretical concept. Evaluation includes originality, independence and applicability.
- The student can, with supervision, perform a research project independently, including the formulation of the research question based on good general insight in the field, experimental design and implementation, results analyses and reporting.
- The student is capable of adequate analysis of findings, including appropriate levels of statistics and integration with existing (published) information.
- The student can summarize, document, report, and reflect on own findings.

General competence

- The student knows how to analyse relevant general issues in neuroscience including field specific theorems and ethical issues, including how to decide on animal and human research, general insight in ways to diminish research that causes suffering to humans and animals and knows how to evaluate and weight the outcome to the inflicted suffering.
- The student is capable to apply his/her knowledge and capabilities to analyse and carry out complex experiments in neuroscience in not-familiar domains.

- The student has proven capability to apply his/her knowledge to new domains within neuroscience; has skills and knowledge to search for relevant data on his/her own scientific question, and can critically assess published data within the theoretical framework chosen for a particular project.
- The student can carry out research independently and knows how to formulate and express results and interpretations of the research outcomes.
- The student knows how to participate in discussions, put forward his/her results both in a constellation of peers as well as for lay-people.
- The student has proven capabilities to contribute to the generation of new idea/concepts/technical approaches to experimental research questions.
- The student can summarize, document, report, and reflect on own findings.

Learning outcome for Master of Science in Neuroscience

After completion of the programme the student	**Knowledge**	**Skill**	**General competence**
has in depth insight in basic brain structure and function reaching from the molecular to systems level.	3	1	3
understands how neural systems contribute to sensory experiences, thoughts, emotions, behaviour	2	2	3
can apply and adopt experimental methods to gain new knowledge	2	3	2
can formulate a research question based on adequate insight into current knowledge	3	3	2
is able to report outcomes of research in a coherent oral and written report	3	2	2

1 = elementary; 2 = average; 3 = advanced

Target Groups and Admission Requirements

The MSc in Neuroscience is suitable for students motivated towards research in Neuroscience in particular or the natural sciences in general. *Some previous basic knowledge of Neuroscience and/or Cell and Molecular Biology is highly recommended.*

Admission to the MSc in Neuroscience requires a bachelor's degree (or an equivalent 3-year higher education) in one of the following disciplines:

1. Neuroscience
2. Biology, Biotechnology, Biomedical Science
3. Chemistry, Mathematics, Physics
4. Psychology
5. Human Movement Science, Medicine

Other relevant disciplines, combined with or including course work in Biology, Chemistry, Mathematics/Statistics, Neuroscience and/or Physics, may be accepted after an individual evaluation of the applicant's qualifications.

Applicants are encouraged to include the NTNU-based course NEVR2010 – *Introduction to Neuroscience* as a part of their bachelor's degree. Students who do not have NEVR2010 (or an equivalent background in Neuroscience) when admitted, may be required to follow the NEVR2010 lectures during their first semester of the master's programme.

International applicants need to submit proof of English proficiency (TOEFL, IELTS, APIEL or University of Cambridge test). More details about the language requirements are available at www.ntnu.edu/studies/langcourses/languagerequirements

Applicants who are not citizens of the European Union (EU) or the European Economic Area (EEA) need to provide a financial guarantee to get a residence permit in Norway.

Teaching Methods and Learning Activities

The MSc in Neuroscience is a two-year, full-time programme. The teaching includes lectures, laboratory work/demonstrations and supervised project work. The language of instruction is English.

The master's programme has small classes, which stimulates a good study environment. The students contribute to the interdisciplinary environment with their different educational and ethnical backgrounds. Master's thesis projects are offered in multidisciplinary research teams such that students are exposed to and encouraged to participate in collaborative projects. The language of instruction and examinations is English.

Students will get access to high-tech laboratory environments, and modern reading and lecture rooms, computer labs and library facilities at Øya campus in Trondheim. NTNU shares this campus with St. Olav's University Hospital and Sør-Trøndelag University College.

SOMA is the master's students' own social student organization. SOMA har various activities during the semesters, including welcome parties and other activities for new students, excursions, courses and much more. For more information, visit SOMA's blog: http://somantnu.blogspot.com

Compulsory HSE Training

All master's students must participate in compulsory Health, Safety and Environment (HSE) training. This includes a biosafety lecture and a lecture on laboratory safety and conduct. When these activities have been completed, the student must pass an electronic test. This is to be done by 15 September 2014. If the student fails to do so, the access card to the campus/hospital buildings will be withdrawn.

Programme Structure

The master program is made up of the following three components:

- Master's thesis (60 credits)
- Compulsory courses (37.5 credits)
- Elective courses (22.5 credits)

Master's Thesis

NEVR3901*	Thesis in Neuroscience	60 credits

* The course code FY3901 is used by students with a supervisor at the Department of Physics.

Compulsory Courses

NEVR3001	Basic Neuroscience	7.5 credits	Autumn
NEVR3002	Systems Neuroscience	7.5 credits	Autumn
NEVR3003	Behavioural and Cognitive Neuroscience	7.5 credits	Spring
NEVR3004	Neural Networks	7.5 credits	Spring
Various	Experts in Teamwork	7.5 credits	Spring

Elective Courses

A selection of suggested elective courses is presented below. Other courses at NTNU or other universities can be approved by the Programme Board on request.

Some of the courses have entry requirements and/or restricted admission. Be sure to check this before you register for a course.

Courses with a course code in the 8000-series are at PhD level, but are open for qualified and motivated master's degree students.

The elective courses should normally be at master's degree level (3000-series or higher). However, if the student lacks appropriate background in areas relevant for the master's thesis, undergraduate courses in biology, chemistry, informatics, mathematics, medicine, physics, psychology or statistics may be accepted as well.

Faculty of Humanities:

FI3107	Biotechnology and Ethics	7.5 credits	Autumn
NEVR3005	Philosophy of Neuroscience	15 credits	Spring

Faculty of Information Technology, Mathematics and Electrical Engineering:

IT3708	Sub-symbolic AI Methods	7.5 credits	Spring
TMA4255	Applied Statistics	7.5 credits	Spring

Faculty of Medicine:

KLH3100	Introduction to Medical Statistics	7.5 credits	Autmnn
MOL3001	Medical Genetics	7.5 credits	Spring
MOL3005	Immunology	7.5 credits	Autumn
MOL3008	Analytical Techniques and Instrumentation	7.5 credits	Spring
MOL3010	Animal Cell Culture	7.5 credits	Autumn
MOL3014	Nanomedicine I – Bioanalysis	7.5 credits	Autumn
MOL3015	Nanomedicine II – Therapy	7.5 credits	Spring
MOL3018	Medical Toxicology	7.5 credits	Spring
MOL3020	Virology	7.5 credits	Spring
NEVR3040	Private Study of Neuroscience I	7.5 credits	Both
NEVR3050	Private Study of Neuroscience II	15 credits	Both
NEVR8014	Laboratory Animal Science for Researchers	7.5 credits	Autumn

Faculty of Natural Sciences and Technology:

BI3010	Population Genetics	7.5 credits	Autumn
BI3013	Experimental Cell and Molecular Biology	7.5 credits	Autumn
BI3016	Molecular Cell Biology	7.5 credits	Autumn
BI3018	Patenting and Commercialization of Biotech and Medtech Inventions	7.5 credits	Spring
TBT4145	Molecular Genetics	7.5 credits	Autumn
TFY4265	Biophysical Micromethods	7.5 credits	Autumn
TFY4280	Signal Processing	7.5 credits	Spring
TFY4310	Molecular Biophysics	7.5 credits	Autumn
TFY4320	Physics of Medical Imaging	7.5 credits	Spring

Progression

NEVR3001 and NEVR3002 should be taken during the first semester. NEVR3001 is taught in the first half of the semester, and the final written examination is held in October. NEVR3002 is taught in the second half of the semester and the final written examination is held in December.

NEVR3003 and NEVR3004 should be taken during the second semester. NEVR3003 is taught in the first half of the semester, and the final written examination is held in March. NEVR3004 is taught in the second half of the semester and the final written examination is held in May or June.

The modular course *Information Literacy* is embedded in the four compulsory courses NEVR3001, NEVR3002, NEVR3003 and NEVR3004.

The course *Experts in Teamwork* (EiT) is compulsory for all master's degree students at NTNU, and is taught intensively in the weeks 2, 3 and 4 in the second semester. Read more about EiT here: http://www.ntnu.edu/eit

The elective courses are to be taken when convenient for the work with the master's thesis. In the second semester, the student must choose a topic for the thesis. A contract for the master's thesis including a project description is drawn up by the student and his/her supervisor and submitted to the Department of Neuroscience within 15 March. Due to the nature of experimental projects in Neuroscience, it is recommended to work continuously with the master's thesis during the two years of the programme.

Model of the MSc in Neuroscience (example):

<table>
<tr><th colspan="2">Year 1</th><th colspan="2">Year 2</th></tr>
<tr><td>1st semester (autumn)</td><td>2nd semester (spring)</td><td>3rd semester (autumn)</td><td>4th semester (spring)</td></tr>
<tr><td>NEVR3001</td><td>NEVR3003</td><td colspan="2" rowspan="4">Thesis</td></tr>
<tr><td>NEVR3002</td><td>NEVR3004</td></tr>
<tr><td>Elective course</td><td>Experts in Teamwork</td></tr>
<tr><td>Elective course</td><td>Elective course</td></tr>
</table>

Please note that this is only a suggestion. As mentioned above, the student can choose to start with the thesis already in the first year and postpone one or more of the elective courses to the second year.

The student must have passed all examinations in compulsory and elective courses before the thesis can be submitted.

Course Descriptions

Compulsory Courses

NEVR3001	**Basic Neuroscience**
Credits:	7.5
Period:	Autumn
Teaching methods:	Lectures and supervised project (essay based on literature search). The course is taught in the first half of the autumn semester with a final examination in October. The language of teaching and examination is English. This course has restricted admission. Students admitted to the MSc in Neuroscience are guaranteed a seat. Other students must apply for a seat by the given deadlines. Regular final examination is given in the autumn semester only. Students with legitimate leave of absence at the final examination and students who receive the grade F may take a re-sit examination in the spring semester. In the case of only a few candidates, the re-sit examination may be conducted as an oral examination. Timetable will be made available on the following webpage: https://timeplan.medisin.ntnu.no/timetable_show.php.
Recommended previous knowledge:	NEVR2010 (Introduction to Neuroscience) or equivalent background.
Compulsory activity:	Project (essay based on literature search)
Mode of assessment:	4-hour written examination. Letter grades (A-F)
Credit reduction:	NEVR3020: 7.5 credits
Host department:	Department of Neuroscience
Course coordinator:	Professor Linda White

NEVR3001 has restricted admission. Students admitted to the MSc in Neuroscience are guaranteed a seat. Other students must apply for a seat by the given deadlines.

General learning outcome

The student has an in-depth understanding of mechanisms related to neurotransmitter signaling and glial-neuronal interactions in health and disease

Specific learning outcomes

Knowledge

The student has knowledge about:

- the most common cell types in the nervous system, their individual components and relationships;
- molecular and cellular mechanisms underlying synaptic transmission and plasticity;
- membrane properties resulting in membrane potential, depolarization and hyperpolarization, action potential generation, membrane oscillations;
- cellular signaling cascades, receptor-second messenger systems, receptors in relation to the common transmitters, transmembrane transport, transporters and channels;
- the role of the various glial celltypes and glial-neuronal interaction, in particular glutamine-glutamate cycle

Skills

The student is capable of:

- applying the knowledge to normal signal transduction in neuronal networks;
- applying the knowledge to altered signal transduction as seen in some examples of diseased networks;

- finding relevant published information and writing about a theme within basic neuroscience in a scientific and coherent manner.

General competence

The student is capable of:

- formulating one relevant problem in cellular/molecular neuronal functioning;
- translating this problem in an adequate strategy to find relevant published information;
- summarize the obtained information into a coherent, scientifically acceptable answer to the question posed;
- write a short essay on the problem, possible answers or pragmatic ways to obtain an answer.

Learning outcomes for NEVR3001

After completing and passing the course NEVR3001 the student:	**Knowledge**	**Skill**	**General Competence**
has in-depth insight of basic brain structure and function from the molecular to the anatomical level	3	1	2
understands how molecular, biochemical, cellular and physiological aspects mutually contribute to neural systems	2	1	3
can search relevant sources of information to acquire literacy in basic neuroscience	1	1	1
can formulate a research question based on adequate insight into current knowledge	3	2	2
can report outcomes of research in a coherent oral and written report	1	1	1

1 = elementary; 2 = average; 3 = advanced

Academic content

The course will introduce the student to the study of cellular and molecular mechanisms relevant to functioning of the central and peripheral nervous systems, including mechanisms of synaptic plasticity. The course will also deal with signaling events in brain, receptors and transport systems for important neuroactive substances, and the function of the various cell types in brain. There will be a particular focus on excitatory and inhibitory signaling and its importance in normal functioning and diseases of the nervous system.

The course involves writing an essay, usually under supervision, and based on a literature search of a topic. Topics for the essays are related to the content of the course. The project is evaluated as passed/failed. The student must pass the project assignment before (s)he can take the exam.

NEVR3002	Systems Neuroscience
Credits:	7.5
Period:	Autumn
Teaching methods:	Lectures and supervised project (essay based on literature search). The course is taught in the second half of the autumn semester. The language of teaching and examination is English. Regular final examination is given in the autumn semester only. Students with legitimate leave of absence at the final examination and students who receive the grade F may take a re-sit examination in the spring semester. In case of only a few candidates, the re-sit examination may be conducted as an oral examination. Timetable is available at https://timeplan.medisin.ntnu.no/timetable_show.php
Recommended previous knowledge:	NEVR2010 (Introduction to Neuroscience) or equivalent background.
Compulsory activity:	Project (essay based on literature search)
Mode of assessment:	4-hour written examination Letter grades (A-F)
Credit reductions due to overlapping courses:	NEVR3020: 7.5 credits
Host department:	Department of Neuroscience
Course coordinator:	Post Doctor Pål Kvello

General learning outcome

The student has an in-depth understanding of the overall organization of the vertebrate nervous system, including prevailing concepts on systems-level organization of the CNS.

Specific learning outcomes

Knowledge

The student has knowledge about:

- the definition of a primary cortical system, including thalamo-cortical and cortico-cortical hierarchical processing (feedforward, feedback and parallel transmission/processing pathways);
- sensory processing in the brain (somatosensory, visual, auditory, vestibular, olfactory, taste), including general anatomical and physiological principles, such as primary, secondary hierarchy , topographical organization (homunculus, tonotopy, retinotopy), and elementary processing as found in the visual system (hierarchical processing from edge detection and movement to complex scene recognition, color);
- the organization of the peripheral components of all sensory systems, including receptor types,peripheral-to-central pathways, topology;
- the motor system (primary cortical system including descending pathways, motor unit, basal ganglia, cerebellum);
- unconscious stimulus-response coupling in the brain, (spinal cord segmental reflexes, intersegmental reflexes, complex spinal cord brainstem reflexes, including the proprioceptive reflexus, vestibulo-oculomotor reflexes at the level of mesencephalon, cortex) corticobulbar and corticocerebellar integration;
- role/concept of the thalamus, basal forebrain, amygdala;
- main modulatory systems, cholinergic, histaminergic, dopaminergic, serotonergic and noradrenergic): anatomical location and organization, functional concepts;
- Comparative organization of sensory, motor and modulatory systems –evolutionary concepts.

Skills

The student is capable of:

- applying the knowledge to sensory-motor integration;
- integrating information from different systems into a high order integrative neuronal processing system within the domain of sensory-motor coupling;
- understanding of and conceptualizing different ways in biology to represent the outside world in the brain (multiple ways to solve the problem) in order to generate simple motor responses;
- finding relevant published information and writing about a theme within basic systems neuroscience in a scientific and coherent manner.

General competence

The student is capable of:

- formulating one relevant problem in systems neuroscience;
- translating this problem in an adequate strategy to find relevant published information;
- summarize the obtained information into a coherent, scientifically acceptable answer to the question posed;
- write a short essay on the problem, possible answers or pragmatic ways to obtain an answer.

Learning outcomes for NEVR3002

After completing and passing the course NEVR3002 the student :	**Knowledge**	**Skill**	**General Competence**
has in-depth insight of the basic concepts of the organization of sensory and motor systems	3	1	2
has insight of the basic structural and functional concepts of the major reflex pathways and modulatory systems in the central nervous	3	1	2
has knowledge about the organization of main subcortical integrative systems in the brain	2	1	2
can search and compare relevant sources of information to acquire literacy in basic neuroscience	2	2	2
can report outcomes of research in a coherent oral and written report	2	2	2

1 = elementary; 2 = average; 3 = advanced

Academic content

The lectures describe signalling events of sensory transduction, coding of sensory information, and cellular mechanisms involved in learning and memory of invertebrate model organisms. The lectures also include the motor system and some important neurological diseases presented in the context of the mechanisms described.

The course includes a project that involves writing an essay, usually under supervision and based on a literature search of a topic. The project is evaluated as passed/failed. The student must pass the project assignment before (s)he can take the exam.

NEVR3003	**Behavioural and Cognitive Neuroscience**
Credits:	7.5
Period:	Spring
Teaching methods:	Lectures and supervised project (essay based on literature search). The course is taught in the first half of the spring semester (normally in February and March), with a final examination at the end of March. The language of teaching and examination is English. Regular final examination is given in the spring semester only. Students with legitimate leave of absence at the final examination and students who receive the grade F may take a re-sit examination in the autumn semester. If few candidates, the re-sit examination may be conducted as an oral examination. Timetable: https://timeplan.medisin.ntnu.no/timetable_show.php
Recommended previous knowledge:	NEVR2010 (Introduction to Neuroscience) or equivalent background.
Compulsory activity:	Project (essay based on literature search)
Mode of assessment:	4-hour written examination Letter grades (A-F)
Credit reductions due to overlapping courses:	NEVR3030: 7.5 credits
Host department:	Department of Neuroscience
Course coordinator:	Professor May-Britt Moser

NEVR3003 has restricted admission. Students admitted to the MSc in Neuroscience are guaranteed a seat. Other students must apply for a seat by the given deadlines.

General learning outcome

The student has an in-depth understanding of the neural foundation of behaviour and cognition.

Specific learning outcomes

Knowledge

The student has knowledge about:

- the neural mechanisms for behavior and cognition, covering topics such as reward processing and emotion, planning and behaviour, appetite, pair bonding, learning and memory, sleep, spatial processing, perception and language;
- the neuronal networks/substrates underlying these cognitive and behavioural processes;
- mainstream theoretical concepts on how alterations in these main neuronal networks underlie / cause main neurological and psychiatric clusters of disease;
- the potential relevance of main modulatory systems, cholinergic, histaminergic, dopaminergic, serotonergic and noradrenergic, for normal and abnormal cognitive functioning.

Skills

The student is capable of:

- applying the knowledge to formulate descriptions of cortical integrative processes that serve cognition and conscious behaviour;
- conceiving of and theorizing about the brain as comprised of multiple, mutually dependent functional networks that together generate appropriate adaptive behaviour;
- understanding how cortical and subcortical systems together contribute to complex cognitive behaviour.

General competence

The student is capable of:

- integrating knowledge about the brain into a coherent representation resulting in a consistent explanation of behaviour;
- selecting, evaluating, and integrating of published information on brain and behaviour into a coherent written or verbal account.

Learning outcomes for NEVR3003

After completing and passing the course the student :	**Knowledge**	**Skill**	**General Competence**
has in-depth insight of the basic concepts of the organization of higher order cortical systems	3	2	2
has insight of the basic structural and functional concepts of the major interactions between subcortical and cortical systems	2	2	2
is capable of describing certain cognitive behavioural processes in terms of contributions of and interactions between numerous brain systems	2	1	2
can acquire and evaluate published information relevant to our understanding of cognitive behavior	3	2	2
can report outcomes of research in a coherent oral and written report	3	2	2

1 = elementary; 2 = average; 3 = advanced

Academic content

The course provides a thorough introduction to the biological foundation of behaviour and cognition. It focuses on the neural mechanisms for behaviour and cognition, with particular emphasis on sleep, motivation, learning and memory, language, attention, perception and emotions. Lectures are also given on important neurological and psychiatric syndromes and disorders, with emphasis on the mechanisms behind the different conditions.

The course includes a project that involves writing an essay, usually under supervision and based on a literature search of a topic. The project is evaluated as passed/failed. The student must pass the project assignment before (s)he can take the exam.

NEVR3004	**Neural Networks**
Credits:	7.5
Period:	Spring
Teaching methods:	Lectures and demonstrations. The course is taught in the second half of the spring semester. The language of teaching and examination is English. This course has restricted admission. Students admitted to the MSc in Neuroscience are guaranteed a seat. Other students must apply for a seat by the given deadlines. Compulsory assignment: An essay on a course related topic has to be handed in through it's learning. Further information on possible topics and requirements will be given at the onset of the course. The essay will be evaluated as pass/fail, and a score "pass" is required to be allowed to participate in the written examination. Regular final examination is given in the spring semester only. Students with legitimate leave of absence at the final examination and students who receive the grade F may take a re-sit examination in the autumn semester. In case of only a few candidates, the re-sit examination may be conducted as an oral examination. Timetable: https://timeplan.medisin.ntnu.no/timetable_show.php.
Recommended previous knowledge:	NEVR2010 (Introduction to Neuroscience) or equivalent background.
Compulsory activity:	An essay on a course related topic has to be handed in through it's learning. Further information on possible topics and requirements will be given at the onset of the course. The essay will be evaluated as pass/fail, and a score "pass" is required to be allowed to participate in the written examination.
Mode of assessment:	4-hour written examination. Letter grades (A-F)
Credit reductions due to overlapping courses:	NEVR3030: 7.5 credits
Host department:	Department of Neuroscience
Course coordinator:	Professor Yasser Rashtabadi Roudi

NEVR3004 has restricted admission. Students admitted to the MSc in Neuroscience are guaranteed a seat. Other students must apply for a seat by the given deadlines.

General learning outcome

The student has an understanding of neural network mechanisms of cognition and how these can be studied with and represented by realistic network models at an experimental and computational level.

Specific learning outcomes

Knowledge

The student has knowledge about:

- different classes of network models/modeling approaches currently used in neuroscience;
- different simulation programs/approaches;
- essential mathematical and theoretical concepts relevant to neural networks and theoretical modeling.

Skills

The student is capable of:

- writing simple codes for modeling;
- translating simple biological data sets on neuronal firing or network properties into a theoretical representation.

General competence

The student is capable of:

- critically appraise neural network descriptions and theoretical models of neural networks;
- understanding the difference between neuronal coding and network coding;
- writing a short essay, based on a critical appraisal and integration of a number of computational/theoretical modeling studies on specific neural or network properties.

Learning outcomes for NEVR3004

After completing and passing the course the student :	**Knowledge**	**Skill**	**General Competence**
has an understanding of neural network mechanisms of cognition	2	1	1
Can read and critically appraise publications dealing with modeling of neural network properties	1	2	2
has knowledge about the main types of models currently in use	2	na	na
can search and compare relevant sources of information to acquire literacy in basic neuroscience	3	2	2
Can critically appraise sources of information and contents of scientific publications and choose relevant information	2	2	2
can report outcomes of research in a coherent written report that meets requirements of a scholarly publication	3	2	3

1 = elementary; 2 = average; 3 = advanced

Academic content

Neuroinformatics and network models of brain functions are major topics. The course has a strong focus on models of memory in realistic cortical networks, using both experimental and theoretical (computational) approaches.

The course includes a project that involves writing an essay, usually under supervision and based on a literature search of a topic. The project is evaluated as passed/failed. The student must pass the project assignment before (s)he can take the exam.

NEVR3901 / FY3901	**Thesis in Neuroscience**
Credits:	60
Period:	2 semesters, though it is recommended to work gradually with the thesis during the entire study period.
Teaching methods:	Supervised project according to given guidelines. Practical information is available at www.ntnu.edu/dmf/studies/master
Entry requirements:	The student must be admitted to the Master of Science in Neuroscience. In order to be eligible to defend his/her master's thesis the student must have passed all exams, i.e. compulsory and elective courses worth 60 credits in total.
Mode of assessment:	Thesis and oral presentation/examination. The grade given on the thesis may be adjusted after the oral examination.
Host department:	Department of Neuroscience
Course coordinator:	Professor Menno Witter

The course code FY3901 is used for student with a supervisor at the Department of Physics. All other students should use the course code NEVR3901.

General learning outcome

The student has mastered the principles of an independent problem-focussed experimental approach in neuroscience and can interpret experimental results in the context of critically appraised published information. The student has the skills and competences for continued scientific learning and education.

Specific learning outcomes

Knowledge

The student has advanced knowledge of:

- one subfield/discipline of neuroscience;
- relevant methodologies and techniques in neuroscience including both historical as well as more recent techniques;
- main resources to retrieve scientific information;
- general rules of reporting and publishing scientific reports;
- guidelines for oral presentation;
- best practice in scientific ethical behavior.

Skills

The student is capable of:

- performing a research project independently, but with supervision;
- recognizing, formulating and testing an hypothesis/research question;
- finding relevant methods and to applying those in order to experimentally address a scientific problem/question/hypothesis;
- adequate reporting of applied experimental approaches and obtained experimental results;
- adequate analysis of findings, including appropriate levels of statistics and integration with existing (published) information;
- retrieving and obtaining relevant published scientific information;
- communicating and defending own experimental results and their interpretations both orally and in the format of a master thesis;
- summarizing, documenting, reporting, and reflecting on own findings.

General competence

The student is competent to:

- evaluate ethical principles on animal and human research;
- search for relevant data on his/her own scientific question, and critically assess published data within the theoretical framework chosen for a particular project;
- carry out research independently and knows how to formulate and express results and interpretations of the research outcomes;
- participate in discussions, put forward his/her results both in a constellation of peers as well as for lay-people.

Learning outcomes for NEVR3901/FY3901

After successful defense of the thesis the student	**Knowledge**	**Skill**	**General competence**
has in depth insight one subfield of neuroscience.	3	1	2
can formulate a research question based on adequate insight into current knowledge	2	2	2
can apply and adopt experimental methods to gain new knowledge	2	2	3
can obtain, record and interpret experimental data	3	2	2
can retrieve and interpret published scientific data	3	2	2
is able to report outcomes of research and defend interpretations and conclusions in a coherent way both orally and in writing	3	3	2

1 = elementary; 2 = average; 3 = advanced

Elective courses
(Sorted by course codes)

BI3010	**Population Genetics**
Credits:	7.5
Period:	Autumn
Teaching methods:	Lectures: 30 hours Auditorium lectures with chapter-wise Powerpoint presentations uploaded to It's learning. Control questions (chapter-wise) uploaded to It's learning and treated in plenary sessions in auditory. Various software for genetic simulations and analysis is demonstrated in auditory and made available on It's learning. Lecturers may be available for answering questions sent by email.
Entry requirements:	Basic skills in biology, maths and statistical analysis. Basic skills in English.
Recommended previous knowledge:	The students need previous knowledge corresponding to BI1001, BI1004, BI1003 and BI2017. The students need basic knowledge in algebra, probability theory and statistics.
Mode of assessment:	4-hour written examination Letter grades (A-F)
Credit reductions due to overlapping courses:	MNKBI310 6.0 credits
Host department:	Department of Biology
Course coordinator:	Professor Jarle Mork

Learning outcomes

Knowledge

The candidate shall receive:

- insight in central themes of population genetics;
- knowledge of population genetics analytical tools.

Skills

The candidate shall know and understand:

- basic statistical analyses of genotypic distributions;
- estimates and statistical tests of genetic differences between populations;
- formulae for genetic equilibria between the four evolutionary forces;
- calculations of coancestry- and inbreeding coefficients from pedigree;
- methods for mapping of QTL (queantitative trait loci);

- estimating number of polymorphic loci affecting quantitative traits;
- estimating genetic response in specified selection experiments;
- genetic isolation and different types of speciation processes.

General competence

The candidate shall know and understand:

- general theory and analytical methods in qualitative and quantitative population genetics;
- implementing theory and methods for practical scientific purposes.

Academic content

The course gives an introduction to population genetics (qualitative and quantitative) and its analytical tools. Panmictic populations and genetic equilibium (Hardy-Weinberg). Genetically effective population size (Ne). Wahlund effect. Deviation from panmixia – genetic consequences. Change in gene frequencies due to the evolutionary forces mutation, genetic drift, gene flow, and selection. Measuring genetic differentiation between populations, speciation. Genetic processes in small populations (inbreeding, genetic drift). Molecular evolution and phylogenetics. Neutral and near-neutral theory, geneaology and coalescence. Different types of selection. Breeding genetics theory and methods. Epistasis and pleiotrophy. Evolutionary genetics.

BI3013	**Experimental Cell and Molecular Biology**
Credits:	7.5
Period:	Autumn
Teaching methods:	Laboratory course / demonstrations (40 hours, compulsory) Lectures (20 hours, compulsory)
Compulsory activities:	Laboratory course / demonstrations Approved report
Mode of assessment:	4-hour written examination Letter grades (A-F)
Credit reductions due to overlapping courses:	MNKBI313: 7.5 credits
Host department:	Department of Biology
Course coordinator:	Associate Professor Per Winge

BI3013 has restricted admission, and will be open for master's students in Molecular Medicine and Neuroscience only if there are any available seats. Please contact the Department of Biology if you are interested.

Learning outcome

The aim of the course is to introduce basic methods in cell- and molecular biology. The course includes practical exercises in modern experimental techniques and instruments, and also training in literature search and the use of Internet. Selected analytical methods will be presented and tested. The course also includes analyses of problems and artefacts that generally occur in biological samples examined using chemical and biological analyses.

Academic content

On completion of the course students should be familiar with basic methods in cell- and molecular biology. Students should also be able to demonstrate knowledge of how to use modern experimental techniques and instruments.

BI3016	Molecular Cell Biology
Credits:	7.5
Period:	Autumn
Teaching methods:	Lectures (26 hours) and seminars (24 hours, mandatory)
Mode of assessment:	4-hour written examination
Credit reductions due to overlapping courses:	MNKBI316 7.5 credits
Host department:	Department of Biology
Course coordinator:	Associate Professor Per Winge

Learning outcome

On completion of the course students should have an understanding of cell biology mechanisms on a molecular level, and of the regulation of such mechanisms.

Academic content

Subjects covered include: Apoptose/necrose mechanisms; Kinases/phosphatases classification and regulation; Transcription factors, classification and regulation; Lipid mediators, regulation and function mechanisms; DNA repair mechanisms. Syllabus will mainly be based on research- and review articles.

BI3018	Patenting and Commercialization of Biotech and Medtech Inventions
Credits:	7.5
Period:	Spring
Teaching methods:	The course is held intensively during one week during the months March / April. Lectures and case-based work in groups are repeated for every theme in the course. Oral presentation of work in groups by students. Written assignments are to be submitted two/three weeks after completion of the intensive part of the course. These are performed in groups. Submission written project assignment.
Recommended previous knowledge:	Target group: Master's and PhD students, Tech Trans personnel, Biotech/Medtech staff
Required previous knowledge:	Bachelor's degree or equivalent.
Mode of assessment:	Report Letter grades (A-F)
Host department:	Department of Biology
Course coordinator:	Professor Berit Johansen

Learning outcome

Knowledge: The candidate shall have knowledge about:

- aspects involved in tranforming a research project to commersial product
- IP management;
- patenting; basics, process, national/international law, regulations, practising, similarities/differences;
- scientific versus commercial aspects on patenting strategy/IP evaluations;
- processes involved in transforming a research product to a clinical product;
- models for sale of IP, licensing versus sale;
- business development: IP, business plan, coworkers, financing.

Skills: The candidate can:

- identify and describe the different processes important for conservation of intellectual property of an invention and how to commercialize;
- identify and describe criteria and processes for sale of IP, including business development.

General competence: The candidate can:

- identify and explain principles in processes regulating protection and sale of IP.

Academic content

Topics that will be covered in the course include:

- Patenting: Principles, process, national/international laws, regulations and practice, similarities/differences between European and US patenting laws and practise.
- IPR strategies: Scientific/commercial aspects, how to develop an IP strategy to accelerate the innovation process and to safeguard IP investments, mastering freedom to operate in the Biotech/MedTech industry, Patent litigations, infringements and enforcements.
- Licensing: Models and negotiation strategies.
- Clinical testing: Design, implementation, analysis and presentation of clinical trials, adaptive clinical trial designs.
- Bio-tech/Med-tech business development: Strategy and organization when transferring a scientific idea into a commercial product/business, business plan development, product pipeline analysis, market analysis, market potential prediction, alliance structures and negotiation conditions, capital capture (pre-seed, seed, VC).

Target group: master's and PhD students, Tech Trans personnel, Biotech/Medtech staff, university academic staff.

FI3107	**Biotechnology and Ethics**
Credits:	7.5
Period:	Autumn
Teaching methods:	Lectures, plenary discussions, group work About the essay: The essay topic must be approved by the course instructors. The essay should be approx. 12 pages long in 12-point Times New Roman, 1.5-line spacing. The essay should be based on reading of the student's own choice (100-150 pages), in addition to 200 pages of obligatory readings. The essay should be argumentative. The essay can be written in either Norwegian or English. The essay should be submitted to the Department of Philosophy and Religious Studies (Dragvoll).
Compulsory activity:	Exercise, presentation. Compulsory attendance to lecture.
Mode of assessment:	Essay. Letter grades (A-F)
Host department:	Department of Philosophy
Course coordinator:	To be announced

Learning outcomes

The students will acquire an overview of essential issues related to the development and application of modern biotechnology. They should be able to analyze these issues and to discuss and reflect on how to solve problems within this field, both orally and in writing.

Academic content

FI3107 reviews the ethical debate concerning both the research and application of modern biotechnology in a broad sense. Biotechnology is discussed in view of relevant ethical theories, worldviews, and central historical examples and lines of development. Relevant topics are debates concerning assisted reproduction, animal experimentation, organ donation, genetic improvement, the use of genetic information, selective abortion and euthanasia. Other issues of importance are precaution and risk assessment in relation to applications of biotechnology in agriculture and aquaculture.

IT3708	**Sub-symbolic AI Methods**
Credits:	7.5
Period:	Spring
Teaching methods:	Regular lectures and homeworks, each lasting 2-4 weeks. The final grade is based 100% upon these homeworks, which normally consist of large programming projects along with 1 or 2 essays. In total, a semester involves 4-5 homeworks. This course is VERY programming intensive and should not be taken by students who dislike writing code. Group work on programming projects is acceptable, but group size cannot exceed 2 members. However, any homework that consists solely of a report must be done individually, with no assistance given by one student to another.
Entry requirements:	TDT4136 Logic and Reasoning Systems, TDT4110 Information Technology, Introduction and at least one university-level course in mathematics or equivalent.
Recommended previous knowledge:	TDT4120 Algorithms and Data Structures and MA0301 Elementary Discrete Mathematics.
Mode of assessment:	Five assignment. Each counts for 20 % of the final grade. Letter grades.
Credit reductions due to overlapping courses:	IT8801 7.5 credits MNFIT378 7.5 credits MNFIT378(v.2) 7.5 credits
Host department:	Department of Computer and Information Science
Course coordinator:	Professor Keith Downing

Learning outcomes

Students will get both theoretical and practical programming experience with two of the best known sub-symbolic AI methods: artificial neural networks and evolutionary algorithms.

Academic content

The main focus of the course is to build intelligent systems based on two key natural concepts: the brain, and evolution by natural selection. In computer-science, the analogs for these are artificial neural networks (ANNs) and evolutionary algorithms (EAs). Both methods have thousands of useful applications in fields as diverse as control theory, telecommunications, music and art. This course discusses both methods in great detail along with providing a bit of the biological basis for each.

KLH3100	Introduction to Medical Statistics
Credits:	7.5
Period:	Autumn
Teaching methods:	Lectures and exercises. Approved exercises from the same or previous semesters are required to sit for the exam. Approved compulsory activities are valid for three subsequent semesters after approval.
Required previous knowledge:	The course is primarily intended for students admitted to a 2-year master's programme at the Faculty of Medicine, NTNU. Other students may be accepted after an individual evaluation.
Compulsory activitiy:	Exercise assignments
Mode of assessment:	4-hour written examination Letter grades (A-F)
Credit reductions due to overlapping courses:	HLS3550: 7.5 credits KLH3004: 7.5 credits KLMED8004: 5.0 credits MNFSIB1: 7.5 credits ST3000: 7.5 credits ST3001: 7.5 credits
Host department:	Department of Cancer Research and Molecular Medicine
Course coordinator:	Associate Professor Turid Follestad

Learning outcome

After completing the course KLH3100, the student is able to:

- choose suitable descriptive measures for presenting data for continuous and categorical variables in an empirical dataset (measures of central location and spread, frequencies, graphical methods);
- apply and understand some theoretical aspects of statistical methods for comparing mean values and proportions in two samples, methods for evaluating linear associations between two continuous variables, and methods for evaluating agreement in repeated measures;
- perform the practical work with statistical analyses by means of a statistical software package;
- describe and interpret results from statistical analyses of empirical data;
- critically evaluate validity of results in view of assumptions on chosen statistical method.

Academic content

- Introduction to the statistical software package SPSS.
- Descriptive statistic for continuous and categorical variables (measures of location and spread, frequency tables, graphical display), probability and probability distributions, estimation, hypothesis testing, one- and two-sample tests on mean values (Student T-test), non-parametric tests (Wilcoxon signed-rank test and Mann-Whitney U test), tests on differences in proportions (cross-table analysis; chi-square test and McNemar’s test, Fisher’s exact test), correlation and simple linear regression, methods for assessing agreement (Kappa coefficient, Bland-Altman plot).

MOL3001	Medical Genetics
Credits:	7.5
Period:	Spring
Teaching methods:	Lectures, student presentations, laboratory course and alternative methods of teaching. The lectures and the exam will be in English. If few candidates, alternative exam arrangements may be used. Timetable: https://timeplan.medisin.ntnu.no/timetable_show.php
Recommended previous knowledge:	Biochemistry and basic genetics
Compulsory activities:	Laboratory course
Mode of assessment:	4-hour written examination Letter grades (A-F)
Host department:	Department of Laboratory Medicine, Children's and Women's Health
Course coordinator:	Associate Professor Wenche Sjursen

Learning outcome

After completing the course MOL3001 the student is able to:

- describe central examples of monogenic, polygenic and chromosomal disorders;
- recognise patterns of mendelian inheritance of monogenic diseases, and explain genetic and biochemical mechanisms of some central monogenic disorders;
- describe and understand mechanisms underlying numerical and structural chromosomal aberrations and principles mediating chromosomal disease;
- describe what genetic counselling and risk assessment are, and how genetic counselling is regulated by law in Norway;
- describe and understand central principles and examples in cancer genetics, including sporadic and hereditary cancers;
- describe and understand principles for methods of genetic diagnosis, i.e. gene tests and cytogenetic methods;
- describe and understand principles and methods for gene mapping - calculate frequencies of genetic variants at individual and population based level.

Academic content

The course will give an overview of mechanisms for development of genetic diseases. Topics include different patterns of inheritance, like dominant, recessive, autosomal and sex linked inheritance. Genetic diseases will be classified in single-gene, chromosomal and multifactorial disorders. It will be discussed how identification of genes and variants in the genome, including gene mapping, make it possible to understand how variation can lead to disease.

MOL3005	Immunology
Credits:	7.5
Period:	Autumn
Teaching methods:	Lectures and colloquiums (not compulsory). The language of teaching is English. Timetable: https://timeplan.medisin.ntnu.no/timetable_show.php Information will be communicated on It's learning.
Recommended previous knowledge:	Basic knowledge within cell biology and biochemistry/molecular biology.
Mode of assessment:	4-hour written examination Letter grades (A-F)
Credit reductions due to overlapping courses:	BI2013: 7.5 credits MNKBI213: 7.5 credits
Host department:	Department of Laboratory Medicine, Children's and Women's Health
Course coordinator:	Post Doctor Ingvild Bjellmo Johnsen

Learning outcome

After completing the course MOL3005 the student is able to:

- demonstrate the basic knowledge of immunological processes at a cellular and molecular level;
- define central immunological principles and concepts;
- outline, compare and contrast the key mechanisms and cellular players of innate and adaptive immunity and how they relate;
- understand the principles of central (antibody-based) immunological methods to an extent that he/she can set up a theoretical experiment;
- elucidate the genetic basis for immunological diversity and the generation of adaptive immune responses;
- outline key events and cellular players in antigen presentation, and how the nature of the antigen will shape resulting effector responses;
- identify the main mechanisms of inflammation;
- understand the principles governing vaccination and the mechanisms of protection against disease;
- understand how immunodeficiencies related to disease;
- understand and explain the basis of allergy and allergic diseases.

Academic content

The immune system governs defense against pathogens and is of importance for development of autoimmune diseases, allergy and cancer. The course discusses basic immunology including cellular and molecular processes that represents the human immune system. Subjects to be presented include cells and organs of the immune system, antigen, immunoglobulins and antibody diversity, molecular mechanisms of innate and adaptive immunity, the complement system, antigen presentation, cell-mediated effector responses, immunological techniques and select lecture on the immune system in health and disease.

MOL3008	**Analytical Techniques and Instrumentation**
Credits:	7.5
Period:	Spring
Teaching methods:	Lectures and laboratory course. The course is offered by the Department of Technology at Sør-Trøndelag University College (HiST). Lecturers are Liv Thommesen, Geir Bjørkøy, Randi Utne Holt, Eli Kjøbli and Ragnhild Bach. *The course will not be taught if less than 12 students register for the examination. If you intend to take the course, we kindly ask you to register early (preferably by 1 February 2015).*
Compulsory activity:	Laboratory course
Mode of assessment:	4-hour written examination Letter grades (A-F)
Host institution:	Sør-Trøndelag University College
Course coordinator:	Professor Liv Thommesen

Learning outcome

After completing the course MOL3008 the student is able to:

- explain the basic principles of analyses and detection systems involved in photometric-, fluorometric- and luminescence-based methods;
- explain principles of electrophoresis and immunochemical techniques and discuss how these techniques can be used in molecular medicine;
- discuss the use of enzyme kinetics in analytical methods;
- explain basic principles for chromatographic separation techniques;
- discuss quality control, error sources, documentation and storage of experimental data

Academic content

- Introduction to main principles of analyses and detections system
- Optical techniques, chromatography, electrochemistry and chemical sensors, immunochemical techniques, measurement of enzymatic activity
- Automation in clinical laboratory
- Quality control
- Evaluation of methods

MOL3010	**Animal Cell Culture**
Credits:	7.5
Period:	Autumn
Teaching methods:	Self-tuition. The language of the examination is English.
Recommended previous knowledge:	Basic knowledge in cell biology and biochemistry. One should have some experience with cell culture work.
Mode of assessment:	Oral examination Letter grades (A-F)
Host department:	Department of Laboratory Medicine, Children's and Women's Health
Course coordinator:	Post Doctor Jostein Malmo

Please note that this course is based on self-tuition. It will not be given any lectures.

Learning outcome

After completing the course MOL3010 the student is able to:

- demonstrate knowledge of basic cell culture techniques;
- demonstrate knowledge of establishment of cell inlines and their maintenance;
- demonstrate knowledge on design and use the cell culture facilities;
- critically evaluate cell cultures constraints and possibilities as an in vitro model;
- discuss the advantages and limitations of primary cell culture compared to immortalized or transformed cell lines.

Academic content

The course will focus on practical aspects of cell culture, like design and layout of the laboratory, aseptic technique, cloning and selection of specific cell types, contamination, methods for measuring viability and cytotoxicity, cell culture environment (substrate, gas phase, medium) and the culturing of specific cell types.

MOL3014	**Nanomedicine I - Bioanalysis**
Credits:	7.5
Period:	Autumn
Teaching methods:	The syllabus of the course is defined by the learning objectives. The course is based on lectures given by experienced researchers within each theme. The course includes a compulsory project providing an in-depth review of the primary litterature, which will account for 25 % of the final grade. There might be simple lab exercises dependent on number of students enrolled. The language of instruction is English. Timetable: https://timeplan.medisin.ntnu.no/timetable_show.php
Recommended previous knowledge:	Basic skills in molecular biology, cell biology, chemistry, physics. Most suited for students who have completed courses in basic molecular and cell biology.
Mode of assessment:	4-hour written examination – 75 % of the final grade Exercise / Project – 25 % of the final grade Letter grades (A-F)
Host department:	Department of Cancer Research and Molecular Medicine
Course coordinator:	Professor Øyvind Halaas

Learning outcome

After completing the course MOL3014 the student is able to:

- understand how nanotechnology can be tailored and used for biomedical purposes;
- understand the problems and possibilities for analysis of proteins, nucleic acids and cells by micro fabricated devices and nanotechnological solutions;
- outline fabrication procedures and general considerations for microfluidics;
- understand how nano-relevant instruments such as focused ion beam scanning electron microscopes, atomic force microscopes and optical microscopes can be used in biomedicine;
- perform simple micro fabrication procedure;
- find, refer and consider relevant information.

Academic content

This course will cover fundamentals of bioanalysis and module integration for applications. In detail the course will contain:

- Advanced protein and DNA chemistry.
- Methods for quantification and identification of DNA/RNA and protein with focus on technical principles and emerging nanotechnologies.
- Use of imaging in nanoscale for biomedical research.
- Microfluidics.
- Principles for and contruction of lab-on-a-chip and biosensors.
- Nanoneuroscience.

This course is focused on technology rather than biology.

MOL3015	**Nanomedicine II - Therapy**
Credits:	7,5
Period:	Spring
Teaching methods:	The syllabus of the course is defined by the learning objectives. The course is based on lectures given by experienced researchers within each theme. The course includes a compulsory project providing an in-depth review of the primary litterature, which will account for 25 % of the final grade. The language of instruction is English. The lectures are held in the spring semester and start in early February. Timetable: https://timeplan.medisin.ntnu.no/timetable_show.php
Recommended previous knowledge:	Basic skills in molecular biology.
Mode of assessment:	4-hour written examination – 75 % of the final grade Exercise / Project – 25 % of the final grade Letter grades (A-F)
Host department:	Department of Cancer Research and Molecular Medicine
Course coordinator:	Professor Øyvind Halaas

Learning outcome

After completing the course MOL3015 the student is able to:

- understand how nanotechnological approaches can be used in biomedical therapies;
- understand biomaterials and interaction of biomaterials with cells, body fluids and tissues;
- understand basic stem cell biology and corresponding requirement for tissue engineering;
- understand the need, obstacles and solutions for polymeric, lipidous and solid nanosized drug delivery systems;
- understand the toxicological aspects of nanosized surfaces and particles;
- find, refer and evaluate available information.

Academic content

The course will introduce use of nanotechnology in therapy. In detail, the course will cover

- Clinical biomaterials, tissue regeneration, including stem cell technology, immunological limitations and encapsulation strategies.
- Methods and possibilities for drug discovery.
- Use and design of nanoparticles for gene therapy, drug delivery and drug targeting.
- Physiological, cellular and toxicological limitations for medical use of nanoparticles.
- Theranostics, the combined use of in vivo imaging/diagnostics and therapy.
- Ethical, legal and social aspects (ELSA) related to use of medical nanotechnology will be discussed.

A written report is included, where the student will choose a theme from the lectures, review the literature, describe current methods, consider and recommend use of emerging nanotechnologies in a therapeutic setting.

MOL3018	Medical Toxicology
Credits:	7.5
Period:	Spring
Teaching methods:	Lectures. The language of instruction and examination is English. The course is taught in the spring semester, and starts in late January or early February. Timetable: https://timeplan.medisin.ntnu.no/timetable_show.php
Recommended previous knowledge:	Passed examinations in BI1001 and BI1004, or TBT4100 and TBT4105 (or similar courses).
Required previous knowledge:	Basic knowledge of physiology, chemistry, biochemistry and mathematics.
Mode of assessment:	4-hour written examination Letter grades (A-F)
Credit reductions due to overlapping courses:	TOKS1010: 7.5 credits TOKS3010: 7.5 credits
Host department:	Department of Cancer Research and Molecular Medicine
Course coordinator:	Associate Professor Bent Håvard Hellum

Learning outcome

After completing the course MOL3018, the student is able to:

- describe and explain toxicological mechanisms;
- perform simple analysis of how some chemicals might be a possible health hazard upon exposure;
- explain how certain xenibiotics in the environment and work can have toxic effects on central organs and organ systems in humans;
- collect relevant background data regarding toxicologial problems.

Academic content

The course gives an introduction to general pharmacokinetic models. Liver, kidney, lung, the immuno- and nervous system will be discussed as target organs for chemical toxicity. Groups of toxic agents and substances of abuse will also be included. Major weight will be put on available methods for risk assessment of human expose to cancer and non-cancer agents.

MOL3020	Virology
Credits:	7.5
Period:	Spring
Teaching methods:	Lectures and alternative methods of teaching. Teaching and exam will be in English. If few candidates sign up alternative examination may be considered and used. Timetables for courses at the Faculty of Medicine are available at https://timeplan.medisin.ntnu.no/timetable_show.php
Recommended previous knowledge:	Knowledge in microbiology, cell biology, biochemistry, and molecular biology
Mode of assessment:	4-hour written examination Letter grades (A-F)
Host department:	Department of Laboratory Medicine, Children's and Womens Health
Course coordinator:	Professor Marit Walbye Anthonsen

Learning outcome

After completing the course MOL3020, the student is able to:

- demonstrate a general knowledge in molecular virology;
- describe elements of the viral life cycle;
- explain viral replication strategies;
- describe viral recognition mechanisms and immunological defense responses;

- discuss principles of virus pathogenesis;
- outline viral molecular epidemiology;
- explain vaccine strategies and mechanisms of antiviral drugs.

Academic content

The course will give an overview of medically important virus families, their replication strategies and mechanisms for development of viral infectious diseases. Topics will include taxonomy, replication strategies, pathogenicity and transmission of viruses and, additionally, diagnosis, prevention and treatment of viral diseases. Antiviral immunity and viral immuno-evasion will also be covered. Common human viral infections will be the main focus of the course, and emphasis will be put on virus-host interactions as a key to understanding the diversity of viruses and viral diseases.

NEVR3005	**Philosophy of Neuroscience**
Credits:	15
Period:	Spring
Teaching methods:	Lectures, supervision and self-study. The assessment is based on an essay written with supervision, which makes up 60% of the final grade, and a six-hour written exam (no materials), which makes up 40% of the final grade. Both parts of the form of assessment must be given a pass grade. The written exam aims to test a wide part of the curriculum of the course. In case of retakes, students must redo both exams. Practical information regarding the essay: Date for submission available later. Three hard copies before 2 p.m. to the Department of Philosophy Office or the Department of Neuroscience Office. Length: 15-20 pages using 12-point Times New Roman, 1.5 line spacing. Front page: Course code, date, candidate number.
Entry requirements	NEVR2010 or equivalent
Recommended previous knowledge:	Basic knowledge of philosophy of science Basic knowledge of molecular and cellular neuroscience
Compulsory activity:	Approved course material/reading list
Mode of assessment:	Home examination (60%) Written examination (40%) Letter grades (A-F)
Host department:	Department of Philosophy
Course coordinator:	To be confirmed

This course will not be taught in the academic year 2014/2015.

Learning outcomes

To acquire the knowledge and ability to be able to discuss and evaluate some of the foundational philosophical problems in neuroscience, e.g. the nature of explanation in neuroscience, the relationship(s) between the self and the brain, and in what way neural mechanisms enable consciousness and the will.

Academic content

The aim of the course is to address some foundational philosophical problems in neuroscience. The course will focus on three areas: 1) the nature of mechanisms in neuroscience; 2) the nature of biological emergence and complexity; and 3) the neurobiological basis of the self. These areas, not independent of each other, will be investigated through different accounts of the relationship between cognitive phenomena such as perception and memory and the neural mechanisms underpinning such mental functions. This problem, however, is just a part of the more general problem of relating the mind to the brain. How are we to link molecules to mind? Can the mind be wholly decomposed to neural signalling and interacting molecules? Or is the way cells and molecules are organized in

circuits, tissues and organs causally and explanatory essential? Perhaps a plausible account of the mind/brain nexus must, explain how mental phenomena are enabled by 'lower level' mechanisms, and how emergent 'higher-level' structures and processes at the system level can influence their component parts. In short, examining the nature of neural mechanisms and the way these mechanisms are organized in nervous systems may shed light on the fundamental nature of the self, consciousness and the will.

NEVR3040	**Private Study of Neuroscience I**
Credits:	7.5
Period:	Autumn / spring
Teaching methods:	Private study. The language of examination is English.
Entry requirement:	The student must be admitted to the Master of Science in Neuroscience.
Recommended previous knowledge:	Passed NEVR3001, NEVR3002, NEVR3003 and NEVR3004.
Mode of assessment:	Oral examination Letter grades (A-F)
Credit reductions due to overlapping courses:	NEVR3050 7.5 credits
Host department:	Department of Neuroscience
Course coordinator:	Research Fellow Tora Bonnevie

Learning outcomes

After completing the course NEVR3040, the student

1. has detailed knowledge about a specific topic in neuroscience;
2. is capable of applying this knowledge to obtain an advanced functional understanding, ranging from underlying mechanisms to general principles;
3. can obtain relevant published information on that topic;
4. can critically assess and integrate published scientific information into a coherent and scientifically acceptable summary.

Academic content

The course consists of an individual curriculum associated with the master's thesis. The topic may, but does not have to be related to the thesis. The examination is normally held at the same day as the master's thesis examination, and with the same examiner.

NEVR3050	**Private Study of Neuroscience II**
Credits:	15
Period:	Autumn / spring
Teaching methods:	Private study, 2-3 semesters. The language of examination is English.
Entry requirements:	The student must be admitted to the Master of Science in Neuroscience.
Recommended previous knowledge:	Passed NEVR3001, NEVR3002, NEVR3003 and NEVR3004.
Mode of assessment:	Oral examination Letter grades (A-F)
Credit reductions due to overlapping courses:	NEVR3040 7.5 credits
Host department:	Department of Neuroscience
Course coordinator:	Research Fellow Tora Bonnevie

Learning outcomes

After completing the course NEVR3050, the student:

1. has detailed knowledge about a specific topic in neuroscience;

2. is capable of applying this knowledge to obtain an advanced functional understanding, ranging from underlying mechanisms to general principles;
3. can obtain relevant published information on that topic;
4. can critically assess and integrate published scientific information into a coherent and scientifically acceptable summary.

Academic content

The course consists of an individual curriculum associated with the master's thesis. The topic may, but does not have to, be related to the thesis. The examination is normally held at the same day as the master's thesis examination, and with the same examiner.

NEVR8014	**Laboratory Animal Science for Researchers**
Credits:	7.5
Period:	Autumn
Teaching methods:	Lectures, study groups and individual assignments. The course consists of 35 hours of lectures(given in week 47), 24 hours of self-tuition (group work and individual assignments) and 21 hours of practical training. The requirements are set by the Department of Agriculture (http://oslovet.veths.no/Oppl/nye.html#KatC). You must arrange the 3 days of practical training yourself. This is usually done in your own research group. The training must be supervised by a person with FELASA C or B competence. Then the practical training documentation must be signed and approved by the local veterinarian at the laboratory animal facility.
Recommended previous knowledge:	Biomedical education, courses in statistics, knowledge of literature search on the internet and in the library.
Required previous knowledge:	A 3-year education on university or college level is a prerequisite in order for the participant to use the title "FELASA category C, Researcher" when the compulsory activities (see the below) have been carried out. Enrolment in a PhD programme, master programme or at "forskerlinjen" in medicine at NTNU. PhD and "forskerlinje" students at the medical faculties at the universities in Bergen, Oslo and Tromsø are given access according to a mutual agreement between these institutions. Others are referred to the course MDV6003.
Compulsory activities:	Lectures (five days). Individual assignment.
Mode of assessment:	4-hour written examination Passed/not passed
Host department:	Department of Cancer Research and Molecular Medicine
Course coordinator:	Post Doctor Marianne Waldum Furnes

Learning outcome

After completing the course NEVR8014 the student:

- shall know the principles behind modern theory on animal experiments and welfare
- knows the legislature regulating the use of lab animals in Norway
- knows the potential health hazards related to animal experiments, and how to minimize these hazards
- understands the significance of the internal and external factors influencing a lab animal and which thereby may influence the outcome of the experiment
- knows roughly how to monitor the health of lab animals
- understands the most important principles for chosing methods for handling and treating lab animals
- understand the principles behind anaesthesia, analgesia and humane killing of lab animals

- understands the general principles for planning animal experiments, including quality control and know of the potential alternatives and supplements to animal experiments which exist
- is able to evaluate a published article on animal experiments with emphasis on how the animals are described and used and know of and be able to use guidelines for good reporting of animal experiments
- has insight into the most important factors which decide the running of a research department using lab animals and be able to do a simple evaluation of a department
- has an attitude towards the lab animals which reflect "the three R's" with focus on animal protection and animal welfare (Replace, Reduce, Refine).

Academic content

FELASA = Federation of Laboratory Animal Science Associations. We follow their minimum recommendations for education and training for researchers (FELASA C researcher). This means that you most likely can travel with your Diploma (FELASA C) to other European countries and work with Laboratory animals. But other countries might ask for additional training and have more stringent rules. Legislation, Ethics and views in society; the course of events in animal experiments; biology of lab animals; the choice of species; genetical and environmental factors influencing animal experiments; health hazards; principles concerning the handling of animals, anesthesia, analgesia and humane killing of lab animals; evaluation and quality control of animal experiments; reporting; alternatives to animals experiments; literature search. The course is divided into two sections; a general section (3 days) and a selectable section (2 days) where the students can choose between traditional laboratory animals and fish/aquatic organisms. Course participants should select their specialization on the basis of the animals they will work with after the course. Traditional animals specialization: laboratory animals biology, health monitoring, anesthesia and euthanasia, ethology, genetics, transgenic animal models, handling techniques. Fish specialization: Legislation concerning fish, experimental conditions, stress, biorythms and acclimatization, pain and suffering, anesthesia, handling, surgical procedures and euthanasia, aggression and hierarchy formation, health monitoring and microbiological qualities, transgene fish.

TBT4145	**Molecular Genetics**
Credits:	7.5
Period:	Autumn
Teaching methods:	Lectures, laboratory work (intensive lab course). The course will be given in English. If there is a re-sit examination, the examination form may be changed from written to oral.
Recommended previous knowledge:	Background in biochemistry basic and advanced course (TBT4102 and TBT4107). The course has limited attendance. Please register for attendance in accordance with general deadlines.
Compulsory activity:	Assignments
Mode of assessment:	4-hour written examination Letter grades (A-F)
Credit reductions due to overlapping courses:	SIK4045 7.5 SP
Host department:	Department of Biotechnology
Course coordinator:	Professor Sergey Zotchev

Restricted admission. Application deadline 1 June (StudentWeb).

Learning outcomes

To understand how the genetic information in prokaryotic and eukaryotic organisms is organized and realized, and to acquire basic knowledge about the methods used to study these topics. It will be important to understand a link between bioinformatics and laboratory-based experiments. The students should also obtain a basic understanding of how this knowledge can be used in applied biotechnology,

and be able to suggest experimental solutions to common problems occurring in basic and applied molecular genetic research.

Academic content

The course aims at providing an introduction to the basic principles of the molecular genetics of prokaryotic and eukaryotic organisms. The main areas of recombinant DNA technology applications will also be covered. Examples of important topics that will be discussed are: gene organization in pro- and eukaryotes, regulation of transcription and translation, techniques in recombinant DNA technology, bioinformatics in gene and genome analyses, biotechnolgical applications of molecular genetics.

TFY4265	**Biophysical Micromethods**
Credits:	7.5
Period:	Autumn
Teaching methods:	Lectures and laboratory excercises. Teaching will be in English if students on international master programs are attending the course. When lectures and lecture material are in English, the exam may be given in English only. The re-sit examination (in August) may be changed from written to oral.
Recommended previous knowledge:	Background in Cell Biology. Basic Physics at the university level.
Compulsory activity:	Laboratory assignments and report
Mode of assessment:	Portfolio assessment is the basis for the grade in the course. The portfolio includes a 4-hour written exam (80 %) and exercises (20 %). The results for the parts are given in percent scores, while the entire portfolio is assigned a letter grade. A re-sit examination may be changed from written to oral.
Credit reductions due to overlapping courses:	FY8906 7.5 credits, FY8410 5.0 credits, SIF4071: 7.5 credits.
Host department:	Department of Physics
Course coordinator:	Associate professor Magnus Borstad Lilledahl

Learning outcomes

The student should have knowledge concerning the mechanism of molecular exitation and deexitation as well as understand the interaction between light and biological samples. The student should have knowledge about the central techniques within lightmicrosopy as well as practical knowledge concerning the operation of a selection of these techniques. This includes an understanding of the construction, mode of function as well as application area of the following microscopy techniques: - Bright field microscopy with different contrast techniques (Phasecontrast-, Differentiel interference-, Modulationcontrast-, Polarisation-, Darkfield-, Reflection interference contrast microscopy (RICM)). - Epiilluminationmicroscopy, including Fluorescencemicroscopy, Confocal laser sanning microskopy, Multiphotonmicroskopy. - Total internal reflection interference microskopy. - Stimulated emission depletion microscopy (STED). - Nearfield microscopy. The student should have knowledge concerning the design and moe of funtion of Flowcytometry. The student should have knowledge concerning the mode of function of the following detectors: The human eye, Photon multiplicator tubes (PMT), Photodiodes, Videocamera, CCD camera. The student should have knowledge concerning the construction, mode of function and application area of optical tweezers. This includes knowledge concerning the prosesses underlying the trapping of particles with light as well as an understanding of the determination of forces using optical tweezers. The student should have knowledge concerning the construction, mode of function and application area of atomic force microsscpy. This includes knowledge converning intermolecular forces, different imaging modes and dynamic force spectroscopy. The student should have knowledge concerning electronmicroscopy and its use for the study of biological samples. This includes knowledge concerning the interaction electrons – biological samples, electron optics, transmission electronmicroscopy (TEM), scanning

elektronmicroscopy (SEM), scanning transmission electronmicroscopy (STEM) and preparation techniques for electronmicroscopy. The student should have knowledge concerning bionanophotonics and microarray technology (DNA and protein microarrays). The student should have skills concerning interpretation and presentation of scientific data obtained during the pratical work in the laboratory. The student should have skills concerning reading of research literature and both written and oral presentation of the content of this literature.

Academic content

The course gives an introduction into the mode of different types of instrumentation that is important for studies of biological macromolecules, cells and other soft materials. The course aims at providing an understanding of the mode of function of the components that the instrumentation consists of as well as a theoretical and practical understanding of how to operate the instrument, including i.e. calibration procedures and maintenance. For each instrument the presentation of the components and the operation principles will be followed by examples of high quality resent research data obtained when using the instrumentation.

TFY4280	**Signal Processing**
Credits:	7.5
Period:	Spring
Teaching methods:	Lectures, calculation assignments, compulsory computer laboratory exercises (MATLAB). When lectures and lecture material are in English, the exam may be given in English only. The re-sit examination (in August) may be changed from written to oral.
Recommended previous knowledge:	Basic physics, mathematics and statistics
Compulsory activity:	Laboratory assignments
Mode of assessment:	4-hour written examination Letter grades (A-F)
Credit reductions due to overlapping courses:	SIF4076 7.5 SP
Host department:	Department of Physics
Course coordinator:	Professor Pawel Tadeusz Sikorski

Learning outcomes

The student is expected to:

1. obtain, through a combined theoretical and experimental approach to the subject, a fundamental understanding of signal processing and needed theoretical and mathematical background to describe signals and systems, experimental measurement signals and time series;
2. learn how to analyze various problems in signal processing using mathematical methods involving differential and integral calculus, as well as ICT-based/numerical methods by using Matlab.

Academic content

The course focuses on basic tools in analysis of analogue and digital signals and systems. Time and frequency domain description of signals. Use of Laplace, Fourier, and Z-transforms. Basic analogue and digital filter design, frequency response, data sampling. Excitation-response analysis of linear systems. Description and analysis of stochastic signals and measured signals with noise, correlations and energy spectrum analysis. Analysis of signals and systems using mathematical methods involving differential and integral calculus, as well as numerical methods using Matlab.

TFY4310	**Molecular Biophysics**
Credits:	7.5
Period:	Autumn
Teaching methods:	Lectures, voluntary problems and mandatory laboratory exercises. Teaching can be in English if students on international master programs are attending the course. When lectures and lecture material are in English, the exam may be given in English only. The re-sit examination (in August) may be changed from written to oral.
Recommended previous knowledge:	Knowledge in physics, mathematics and chemistry according to three years university studies in physics.
Compulsory activity:	Laboratory assignments
Mode of assessment:	4-hour written examination Letter grades (A-F)
Credit reductions due to overlapping courses:	SIF4090 7.5 SP
Host department:	Department of Physics
Course coordinator:	Associate Professor Rita de Sousa Dias

Learning outcomes

Intended learning outcomes: The student should have knowledge of the fundamental molecular principles that underpins the physical properties of biological polymers and biopolymer assemblies: Interactomic bonds and interactions, such as covalent bonds, orbitaltheory, inter- and intramoleluar interactions, the hydrophobic effect, and water – lipid structures. - Dynamics and static properties of biopolymers such as molecular dynamics, the conformation of chain molecules, and swelling properties of biopolymer hydrogels. The student should have knowledge of key experimental methods for the detrmination of the physical properties of biological polymers and biopolymer assemblies: - Methods for determining rheological proprerties of solutions of macromolecules, viscosity and viscoelasticity, transport properties (translational- and rotational diffusion, sedimentation) - Methods for determining spectroscopic properties such as nuclear magnetic resonance, electron spin resonance, optical absorption spectroscopy, circular dichroism, and optical rotation. - Methods for determination of structure and properties by quasielastic scattering techniques, such as X-ray diffraction, fiberdiffraction and light scattering applied to biopolymers. The student should have skills within the practice of applying physical principles for describing molecular properties of biological polymers and biological assemblies. The student should have practical skills in carrying out selected experiments to determine the molecular properties of biopolymers and their assemblies, and communicate this in writing.

Academic content

The course focuses on application of selected topics within physics to describe the molecular properties of biological molecules and biopolymer assemblies, and physical characterisation techniques for their determination.

TFY4320	**Physics of Medical Imaging**
Credits:	7.5
Period:	Spring
Teaching methods:	Lectures and mandatory laboratory assignments or demonstrations. Teaching will be in English if students on international master programs are attending the course. When lectures and lecture material are in English, the exam may be given in English only. The re-sit examination (in August) may be changed from written to oral.
Recommended previous knowledge:	Course TFY4225 Nuclear and Radiation Physics or equivalent is required.
Compulsory activity:	Laboratory assignments
Mode of assessment:	4-hour written examination Letter grades (A-F)
Credit reductions due to overlapping courses:	SIF4094 7.5 credits
Host department:	Department of Physics
Course coordinator:	Associate Professor Pål Erik Goa

Learning outcomes

The student acquires knowledge about physical priciples and methods used in medical diagnostics based on medical imaging. This includes being able to explain principles and implementations of computed tomography (CT) based on the use of nuclear medicine, roentgen X-rays, and magnetic resonance. The student can explain different forms of imaging by ultrasound, and how such imaging is principally different from CT-based imaging. The student acquires skills in evaluating performance parameters, application areas, as well as advantages and disadvantages of different modalities of medical imaging.

Academic content

Medical imaging modalities based on nuclear medicine (SPECT, PET), X-ray computed tomography (CT), ultrasound, and magnetic resonance imaging. Theory for image formation, image noise, image reconstruction and image processing. Quality assurance of medical imaging diagnostics.

TMA4255	**Applied Statistics**
Credits:	7.5
Period:	Spring
Teaching methods:	Lectures and mandatory laboratory assignments or demonstrations. Teaching will be in English if students on international master programs are attending the course. A re-sit examination may be changed from written to oral.
Recommended previous knowledge:	The course is based on ST0103 Statistics with Applications/TMA4240 Statistics/4245 Statistics, or equivalent.
Compulsory activity:	Assignments
Mode of assessment:	Portfolio assessment is the basis for the grade awarded in the course. This portfolio comprises a written final examination 80% and selected parts of the exercises 20%. The results for the constituent parts are to be given in %-points, while the grade for the whole portfolio (course grade) is given by the letter grading system. Retake of examination may be given as an oral examination.
Credit reductions due to overlapping courses:	SIF5066, ST2202, ST2304, TMA4260: 7.5 credits TMA4267: 5 credits
Host department:	Department of Mathematical Sciences
Course coordinator:	Professor Bo Henry Lindqvist

Learning outcomes

1. Knowledge:
The student has a good basic understanding of the most popular statistical models and methods that are used in science and technology. This includes testing of hypotheses, linear regression, experimental design, analysis of variance, error propagation, process control, analysis of contingency tables and non-parametric methods.

2. Skills:
The student knows how to design an experiment to study a phenomenon of interest. Further, he or she knows how to collect informative data of high quality, and subsequently to analyse the collected data using statistical software. The student knows how to present the results from the statistical analyses to colleagues within his or her field of study, and how to use the results of the statistical analysis to draw conclusions about the phenomenon under study.

Academic content

Hypotheses testing. Simple and multiple linear regression. Model choice. Experimental design, including two-level factorial design. Error propagation formula. Analysis of variance. Process control. Contingency tables. Non-parametric methods. Use of statistical computer package.

MASTER OF SCIENCE IN URBAN ECOLOGICAL PLANNING

ADDITIONAL REGULATIONS

Knowledge
• Knowledge of two specific, underprivileged neighbourhoods (one in a developing country, the other in a Nordic country), their territorial strength in terms of organisation, resources, skills and access to land, but also their struggle, and changing livelihood conditions. • Experience in how to address both non-planned and planned neighbourhoods in urban centres and fringe areas for the purpose of livelihood improvements, tenure security and urban upgrading in contexts of conflicts of objectives of equity, environmental sustainability and civil society interests. • Understanding of specific cases of building strategic responsibility and action at higher levels of urban governance and management in terms of 'scaling up' local development initiatives.
Skills
• Knowledge of integrated action planning and integrated local planning processes building both on local defined priorities and local ownership and higher levels strategic action. • Competence in applying, examining and analyzing participative tools. • Ability to use geographical information systems (GIS) as an important tool in urban mapping, planning and management.
General competence
• Awareness of the struggle of the urban poor in terms of entitlements to land, work, and participation in the civil society, and overall livelihood improvements. • Understanding of what are contextual and general issues in local and higher level urban transition in both developing and Nordic countries as well as their localised and interrelated nature. • Knowledge on the interface and the potential conflicts between targeted strategies addressing urban poverty and urban environmental strategies.

1. Learning Goal

The goal of the Masters course in Urban Ecological Planning is to enable the candidates to act as planners in urban settings based on an understanding of the dynamics of urban change in a global context.

The course is grounded in an ideology that focuses on exploring and utilizing contextual knowledge and localized resources while at the same time acknowledging the relational complexity that exist in the urban reality of the developing world. Through a practice oriented learning approach the course adheres to the principles of equity, sustainability and in promoting the interests of the marginalized.

2. Course Structure

This is a two year course where each of the four semesters comprises core modules and electives from the natural or social sciences depending on the candidate's interests or qualifications. There are also multidisciplinary courses, "Experts in Team" that may be chosen as electives.

Semester I: International 'Field Work and Project' taking place in a third country done in cooperation with students from other international universities and faculties of NTNU.

Semester II: Core courses (Urban Ecological Planning; Planning for Sustainability and Development; Research Methods; GIS for Urban Planning).
Semester III: Core courses (Planning Theory, Methods) + electives.
Semester IV: Master thesis; analyses and final write-up.

Individual study plans for each semester has to be agreed upon with the course coordinator and submitted by deadlines set by the university

3. Career Prospects

The course will give the candidate in insight into the dynamics of urban change, and prevalent development challenges of the developing world, and furthermore advise on possible ways of dealing with the constitutive problems and possibilities. The candidate is thus qualified to fill positions within public administration, private and public planning institutions, in private consulting businesses, NGOs, aside from positions in educational institutions. Our candidates have previously settled into all the mentioned positions.

4. Entry Qualifications

1: International Students (excluding students from Nordic countries) Students are required to have a B.Sc/ B. Engg/ BA university degree preferably in Urban Planning, Architecture or Civil Engineering. Candidates with a BA degree in Social Sciences that are relevant to the field of Planning such as Geography, Sociology, Cultural Studies etc in combination with 2 – 5 years work experience in Urban Planning will also be considered for admission.

2: Students from Nordic countries: Equivalent to those for international students. Nordic students may also apply on the basis of exams in relevant areas from the University Colleges (høyskolene).

English Language Requirements:

TOEFL Scroe 500/170

IELTS mark 5.0

5. Studies at other universities

Candidates may spend one of the four semesters as echange student at another university on the condition that the courses taken are equivalent ot those taught at our course.

6. Contacts

For further information on admission and administrative matters: studadm@ab.ntnu.no.

For information on academic matters: hans.skotte@ntnu.no or rolee.aranya@ntnu.no

LIST OF SUBJECTS - MASTER OF SCIENCE IN URBAN ECOLOGICAL PLANNING 2014/2015

Compulsory core courses:

Semester:	Subject no.:	Title:	Note	Autumn	Spring
1.sem	AAR4525	Urban Ecological Planning in Developing Countries. Project work	1	15 Sp	
1.sem	AAR4816	Urban Ecological Planning. Method	1	7,5 Sp	
1.sem	AAR4820	Urban Ecological Planning. Theory	1	7,5 Sp	
2.sem	AAR4944	Planning for Sustainability and Development			7,5 Sp
2.sem		Electives (see list)			7,5 Sp
2.sem	AAR5305	Urban Ecological Planning in Diverse Cultures			7,5 Sp
2. sem	AAR5250	Preparation for fieldwork			7,5 Sp
3.sem	AAR5320	Processing Field Study Data		7,5 Sp	
3.sem	AAR5270	Globalisation and Urban Development		7,5 Sp	
3.sem	FP4350	Planning theory and planning process skills		7,5 Sp	
3. sem		Electives (see list)		7,5 Sp	
4.sem	AAR5400	Master In Urban Ecological Planning			30 Sp

Electives:

Subject no.	Title:	Note	Autumn	Spring
AAR8100	Housing Theory and History	2	7,5 Sp	
GEOG3505	Landscape and Planning	2	15 Sp	
GEOG3506	Geography, Health and Development	1, 2	7,5 Sp	
AAR5260	GIS in Urban Planning	1, 3		7,5 Sp

1) The course will not be offered in 2014/2015

2) Autumn:

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

3)Spring:

Other relevant NTNU courses can be chosen after consultation with the program coordinator

The subject description can be found at http://www.ntnu.no/studier/sokemne

MASTER OF SCIENCE IN SUSTAINABLE ARCHITECTURE

Towards a zero emission built environment

ADDITIONAL REGULATIONS

1. Learning Aims

Participants in the international MSc programme for Sustainable Architecture will learn to identify and apply the correct measures and resources to design high-quality, cost effective architecture that contributes towards achieving a zero emission built environment.

In a global and European perspective, buildings are accountable for about 40 % of all GHG emissions. IPCC reports point to measures in the building sector as being the most economical (when compared to other important sectors).

The MSc programme aims to educate and train building professionals in the use and development of competitive methods and solutions for existing and new buildings that will contribute to lowering GHG emissions related to the production, use, management, and demolition of architecture in a life-cycle perspective. The Master programme encompasses residential, commercial and public architecture as well as its effect on the urban and rural built environment.

2. Course Structure

The curriculum consists of 3 consecutive semesters with theory and project courses, and a fourth semester during which the participants write their MSc thesis. Throughout the two years of the MSc programme, a holistic perspective stresses the many architectural expressions and possibilities encompassed within a zero emission built environment. Within each of the theory and project courses, high demands are made towards integrated design strategies to ensure usability and synergy of the design with its surroundings and users. The students are continuously trained in interdisciplinary co-operation in order for them to integrate this integrated design method in their professional practice.

- Semester 1: Concepts and strategies related to energy efficient, sustainable and zero emission buildings and built environment (theory); Climate and Built Form (theory); Project course
- Semester 2: Use and operation of zero emission buildings (theory); Project course + Experts in Team
- Semester 3: Energy systems and services and their integration in architectural design (theory); Project course + Elective Courses
- Semester 4: Master thesis

3. Career Prospects

The MSc programme in Sustainable Architecture lies in the forefront of research, innovation and implementation related to reducing GHG emissions in architecture which the students will be able to transfer into their practice as building professionals. The continuous focus on integrated design methodology will enable the students to perform in any building design team, both as co-worker and leader.

The programme's close link to the interdisciplinary Research Centre on Zero Emission Buildings ensures close contact with State-of-the-Art research and practice in Norway and abroad with whom the students will be in contact during their education: education and research institutions; producers of materials and products for the building industry; contractors, consultants, architects; trade organisations; public administration; public and private construction and property management; and users. Among the international partners of the Research Centre are VTT (Finland), Chalmers (Sweden), Fraunhofer (Germany), TNO (The Netherlands), LBL and MIT (USA), University of Strathclyde (Scotland), and Tsinghua University (China).

4. Entry Qualifications

A 3-year Bachelor Degree in Architecture, Engineering or Urban Planning. Students with a background in other relevant fields may be considered for admission as well, after discussion with the MSc coordinator and Advisory Board.

English Language Requirements: TOEFL Score 500/170; IELTS mark 5.0

5. Studies at other universities

Students may spend one of the four semesters as exchange student at another university on the condition that the courses taken are equivalent to the programme at NTNU.

6. Contacts

For further information on admission and administrative matters: studadm@ab.ntnu.no.

For information on academic matters: luca.finocchiaro@ntnu.no.

LIST OF SUBJECTS - MASTER OF SCIENCE IN SUSTAINABLE ARCHITECTURE 2014/2015

Semester	Subject no.:	Title:	Note	Autumn	Spring
1st semester	AAR4532	Climate and Built Form Design Project	1	15 Sp	
1st semester	AAR4833	Concepts and Strategies in Sustainable Architecture	1	7,5 Sp	
1st semester	AAR4832	Climate and Built Form	1	7,5 Sp	
2nd semester	AAR4546	Design of Zero Emission Buildings	1		15 Sp
2nd semester	AAR4817	Zero Emission Building Theory	1		7,5 Sp
2nd semester		EiT	1		7,5 Sp
3rd semester	AAR4616	Integrated Energy Design Project		15 Sp	
3rd semester	AAR4926	Integrated Energy Design Theory		7,5 Sp	
3rd semester		Elective Course		7,5 Sp	
4th semester	AAR4993	Master Thesis			30 Sp

Electives:

Subject no.	Title:	Note	Autumn	Spring
Recommended course				
AAR8330	Zero Emission Buildings	1	7,5 Sp	
The student may also choose among the following optional courses				
AAR4850	Light in Lighting		7,5 Sp	
AAR4863	Digital Modeling and Fabrication		7,5 Sp	
TMM4225	Engineering Collaboration in Distributed Teams		7,5 Sp	
FP4100	Arkitektur og stedsforming	2	7,5 Sp	
EP0100	Energifremtider og miljøvisjoner	2	7,5 Sp	
TBA4155	Prosjektplanlegging og analyse	2	7,5 Sp	
TBA4160	Bygningsfysikk, grunnkurs	2	7,5 Sp	
TBA4135	Organisasjon og økonomi i BA-prosjekt	2	7,5 Sp	
GEOG1000	Menneske og sted I	2	7,5 Sp	
TIØ4258	Teknologiledelse	2	7,5 Sp	
TPD4142	Designtenkning	2	7,5 Sp	
FI1105	Etikk	2	7,5 Sp	

The subject description can be found at http://www.ntnu.no/studier/sokemne

1) **The course will not be offered in 2014/2015**
2) **Offered in Norwegian**

MASTER IN SUSTAINABLE URBAN TRANSITIONS 2013/2014

Nordic master programme.

1 Goals

The Nordic Master Programme in Sustainable Urban Transitions (NMP SUT) is a Nordic double degree master programme which has been developed by the Nordic Five Tech (N5T) collaboration. N5T is an alliance of the five leading technical universities: Aalto University (Aalto), Chalmers University of Technology (Chalmers), Royal Institute of Technology (KTH), Norwegian University of Science and Technology (NTNU) and the Technical University of Denmark (DTU). The goal of the N5T alliance is to utilize shared and complementary strengths and create synergy within education, research and innovation.

Perspectives

These different fields of application forms a new joint subject area: planning and design for Sustainable Urban Transitions, where systems thinking, participative and scenario approaches, risk reduction, research by design and generative planning are key concepts. Within this subject area, the aims of the programme are to:

- Provide opportunities for joint learning and understanding of urban planning, design and management as highly complex transition processes, laden with both short-term and long-term uncertainties.
- Support integrated learning and capacity building targeting the variety of involved professionals.
- Show how sociotechnical systems theory, participative and scenario approaches, area-based planning and practice-based research are key concepts in sustainable urban transitions.
- Provide opportunities for learning in different contexts (North and South) and fields of application at the five participating universities, exploiting the strong complementary specialties of the N5T partners to foster highly qualified candidates for public administration, industry and research within sustainable urban transitions.
- The programme is active at four different levels of urban transitions: individual inhabitants/users, neighbourhoods, infrastructural systems, and urban regions. These levels are represented by the programme's five study tracks and the learning outcomes differ depending on study track. Details of the programme's learning outcomes are to be found in the study track descriptions.

Level

The NMP SUT is a two-year 120 ECTS Nordic double degree master programme coordinated by Chalmers and based on the particular expertise of the participating universities. In the double degree programme students study one year at two different universities following a Year one university/Year two university pattern:

- Year one university, 1st and 2nd semesters
- Year two university, 3rd and thesis semesters

The length of the study period in each university corresponds to 60 ECTS.

Relevance

Since continued urbanization will be a major trend globally in the coming decades (from today's three billion to the anticipated six billion urban inhabitants by 2050), future career opportunities for successful NMP SUT students cover a wide field of potential employers and/or clients in both OECD and non-OECD countries. The five study tracks reflect different but equally valid ways to address critical challenges linked to urban transitions. Career opportunities will thus be found in the public sector (agencies for urban/regional planning, management, and governance), in development institutions (local and international), and in both NGOs and consultancy firms active in the field of urban transitions. As the NMP SUT is integrated into the research environments at the five participating universities it also provides a solid platform for pursuing an academic career.

2 Learning outcome (Urban Ecology)

After completing this study track, the candidate should have:

Knowledge

• Knowledge of two specific, underprivileged neighbourhoods (one in a developing country, the other in a Nordic country), their territorial strength in terms of organisation, resources, skills and access to land, but also their struggle, and changing livelihood conditions.

• Experience in how to address both non-planned and planned neighbourhoods in urban centres and fringe areas for the purpose of livelihood improvements, tenure security and urban upgrading in contexts of conflicts of objectives of equity, environmental sustainability and civil society interests.

• Understanding of specific cases of building strategic responsibility and action at higher levels of urban governance and management in terms of 'scaling up' local development initiatives.

• Knowledge of integrated action planning and integrated local planning processes building both on local defined priorities and local ownership and higher levels strategic action.

Reflection

• Competence in applying, examining and analyzing participative tools.

• Ability to use geographical information systems (GIS) as an important tool in urban mapping, planning and management.

Practice

• Awareness of the struggle of the urban poor in terms of entitlements to land, work, and participation in the civil society, and overall livelihood improvements.

• Understanding of what are contextual and general issues in local and higher level urban transition in both developing and Nordic countries as well as their localised and interrelated nature.

• Knowledge on the interface and the potential conflicts between targeted strategies addressing urban poverty and urban environmental strategies.

3 Target group

The programme is open to students with a bachelor in Architecture, Landscape Architecture, Planning (such as Physical Planning and Human Geography with a profile in planning), and Engineering. However, depending on their background (bachelor degree and professional experiences) students can only apply to certain study tracks and, hence, to certain universities (see diagram here). There are a limited and predefined number of student places in each study track and for each category of student (i.e. Architecture, Landscape Architecture, Planning, and Engineering).

Since continued urbanization will be a major trend globally in the coming decades (from today's three billion to the anticipated six billion urban inhabitants by 2050), future career opportunities for successful NMP SUT students cover a wide field of potential employers and/or clients in both OECD and non OECD countries. Career opportunities will thus be found in the public sector (agencies for urban/regional planning, management, and governance), in development institutions (local and international), and in both NGOs and consultancy firms active in the field of urban transitions. As the NMP SUT is integrated into the research environments at the five participating universities it also provides a solid platform for pursuing an academic career.

4 Staff competences

Will be based on the current staff at the Department of Urban Design and Planning with competence within:

- Process knowledge, urban governing, governance
- Urban fabric and infrastructure
- Transportation

- Urban design and land use planning
- GIS
- Planning theory
- Landscape architecture (lacking competence)

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Need competence from planning in developing countries within informal processes.

5 Education /learning

The programme will start autumn 2012. A group of 30 students will be distributed between the universities. NTNU will get 6-8 new students every year.

6 Funding

By the time there is no special funding for the programme.

7 Research

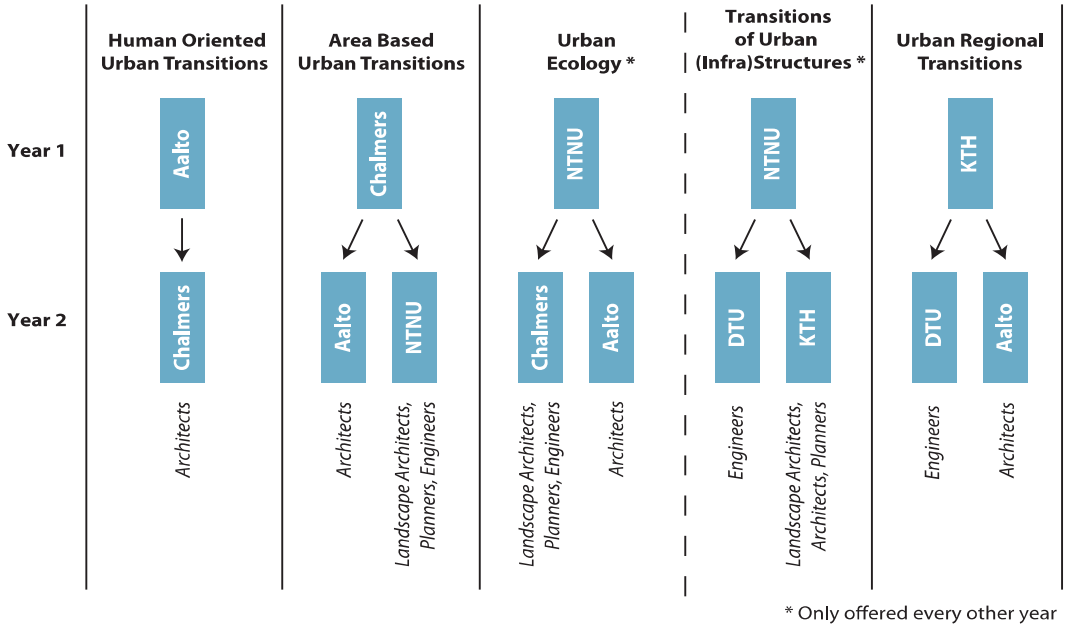
Both the topic, Sustainable Urban transitions, and the cooperation with the leading Nordic universities, make a excellent basis for research within the European research programmes, national programmes and others.

8 Location

Chalmers will coordinate the programme and the students will at NTNU be distributed at existing courses with MUEP, MFP and MA.

The programme will be an interesting basis for a broad, multidisciplinary research programme within Sustainable urban development.

Possible convergence: **Sustainable urban development and transition**



Study track: Area Based Transitions (every Year)

Semester:	Subject no.:	Title:	Note	Autumn	Spring
University 1: Chalmers					
1.sem	AMU018	Sustainable Development and the Design Professions		7,5	
1.sem	ARK172	Planning and Design for Sustainable Development in a Local Context		22,5	
2.sem		Elective Course (see list)			7,5
2.sem		Elective Design Studio (see list)			22,5
University 2: NTNU					
3.sem	AAR4874	Theories and Methods for Master Thesis		7,5	
3.sem	FP4350	Planning theory and process skills		7,5	
3.sem	AAR5270	Globalisation and Urban Development		7,5	
3. sem		Elective course		7,5	
4.sem	AAR5410	Master Thesis			30

Electives

Semester:	Subject no.	Title:	Note	Autumn	Spring
Elective Courses – Chalmers					
2.sem	ARK176	Design Systems 7,5 ect			7,5
2.sem	ARK146	Architectural Conservation and Urban Transformation 7,5 ect			7,5
2.sem	VVT105	Geographical information systems (GIS)			7,5
		Elective Design Studio – Chalmers			
2.sem	ARK161	Reality Studio Kisumu at Lake Victoria, Kenya			22,5
2.sem	ARK347	Architectural Conservation and Urban Transformation			22,5
Elective Courses – NTNU					
3. sem	AAR8100	House Theory and History	1	7,5	

1) Other relevant NTNU courses can be chosen after consultation with the program coordinator

Study track: Urban Ecology (every other year)

Sem	Subject no.	Title	Note	Autumn	Spring
University 1: NTNU 2015/2016					
1.sem	AAR4525	Urban Ecological Planning in Dev. Countries (project)		15	
1.sem	AAR4820	Urban Ecological Planning in Dev. Countries (theory)		7,5	
1.sem	AAR4816	Urban Ecological Planning in Dev. Countries (method)		7,5	
2.sem	AAR5305	Urban Ecological Planning in Diverse Cultures			7,5
2.sem	AAR5250	Preparation for Fieldwork: Research Methods			7,5
2.sem	AAR5260	GIS in urban planning			7,5
2.sem		Electives:			
2.sem	AAR4944	Urban planning for Sustainability and Development			7,5
2.sem	AAR49xx	Experts in Teamwork			7,5

University 2: Chalmers 2014/2015					
3.sem	ARK322	Suburbs: Design and Future Challenges		22,5	
3.sem	ARK460	Advanced theory and methodology – master's thesis preparation course		7.5	
4.sem		Master thesis			30
University 2: Aalto 2014/2015					
3.sem		Urban Laboratory		10	
3.sem		Elective courses (see list)		20	
4.sem		Master thesis			30

Electives

Sem	Subject no.	Title	Note	Autumn	Spring
Elective Courses – Aalto					
3.sem	A-36.3330	Urban Renewal, studio		10	
3.sem	A-36.3504	City in Transition Theory		5	
3.sem	Maa-20.3510	Strategic Urban and Regional Planning		4	
3.sem	21 A00310	Introduction to Management		6	
3.sem	21 E80000	Gender, organizations and management		6	
3.sem	21 E10000	How to change the world: Innovation towards sustainability		6	
3.sem	07124	Context / Upgrading a Neglected Space		12	
3.sem	10157	Designing Services		12	

Study track: Transitions of Urban Structures (every other year)

Sem	Subject no.	Title	Note	Autumn	Spring
University 1: NTNU 2014/2015					
1.sem	AAR4515	Sustainable urban design - project		15	
1.sem	AAR4905	Urban LAB		7,5	
1.sem	FP4350	Planning theory and process skills		7,5	
2.sem	AAR4225	Integrated land use and transportation planning			7,5
2.sem	AAR4605	Urban Design and Architecture			7,5
2.sem	GEOG2009	Vector Based GIS			7,5
2.sem		Electives			7,5
University 2: KTH 2015/2016					
3.sem		Urban Theory, Advanced Course		7,5	
3.sem		Social and Cultural Issues in Planning		7,5	
3.sem		Elective Course (see list)		15	
4.sem		Master's Thesis			30
University 2: DTU 2015/2016					
3.sem	42273	Urban Planning and Sustainable Urban Development		10	
3.sem	42278	Urban Technology and Management		10	
3.sem	42401	Introduction to planning		5	
3.sem	42543	Management of Change		5	
4.sem		Master thesis			30

Electives

Sem	Subject no.	Title:	Note	Autumn	Spring
Elective Course – NTNU 2014/2015					
2.sem		Experts in Teamwork			7,5
2.sem	AAR4944	Urban planning for Sustainability and Development			7,5
Elective Course – KTH 2015/2016					
3.sem	AG2129	Project Sustainable Urban Planning: Strategies for urban & regional development		15 ect	
3.sem	AG2805	Project Sustainable Urban Design: Public Places and Spaces		15 ect	

MASTER OF FINE ART

ADDITIONAL REGULATIONS

QUALIFICATIONS FRAMEWORK - KIT (the Trondheim Academy of Fine Art) **2-year study program at master's degree level.**
Knowledge:
Be capable of using his/her knowledge to develop his/her artistic practice in an independent and innovative way. Have advanced knowledge of relevant international art and art theory; be able to develop, communicate and reflect on his/her own artistic practice and to place this practice in a historical, theoretical and social context Have thorough knowledge of the disciplines in the arts based on international artistic practice and leading research in art theory within the subject area. Develop his/her knowledge of the materials and methods used in the visual arts disciplines and develop critical reflection, making it possible to place his/her artistic practice in an international artistic context.
Skills:
Be capable of analysing his/her own artistic processes with regard to implementation, presentation and communication. Be able to make a professional assessment of artistic challenges as well as practical and theoretical issues, and on that basis make independent choices reflecting a high level of competence in the subject area. Develop his/her practice, method and professionalism so that he/she achieves a level of artistic accomplishment that is independent and has the potential to be sustained over time. Demonstrate the ability to express new problem formulations independently and creatively; contribute to the development of knowledge, and be able to develop new modes of expression.
General competence:
Be capable of navigating in a professional way through complex and unpredictable processes in the visual arts. Develop an in-depth understanding of relevant artistic, social and ethical aspects in the role of art and establish positions of responsibility. Understand the function of art in community building as an important part of cultural life. Be able to initiate and implement professional and interdisciplinary cooperation and to undertake professional responsibility. Demonstrate the ability to identify his/her need for further knowledge and to take responsibility for developing his/her knowledge.

1 Learning outcome

Development of artistic practice and contextualization of the work. From research to concept development, reflection, articulation and realization.

Reflection about contemporary discourse in the field of visual arts.

The innovative two-year graduate program trains students to interrogate and evaluate art and its social and environmental (spatial) implications.

2. Main profile/program of study

The MFA course will focus on the articulation and communication of project ideas to support the artistic development of the MFA student. In this course research / theory is addressed as much as studio practice to learn to contextualize and to examine ones project / work within historic and contemporary parameters of cultural productions. Projects evolve through stages of conceptual and material development to final presentation and critical discussions. This is followed up in our regular class meetings. The objective is to

focus and develop (within the time period of max. two years of study) the project / work to be presented and defended in the final MFA exhibition / exam.

Semester structure, 1st and 2nd semester

Each academic year consists of 2 semesters. Each semester consists of 30 credits

a) ***MFA course*** – theory and practice / mandatory with focus on the articulation and communication of project ideas to support the artistic development of the MFA student.

b) **Lecture program**. Lectures by the professors and visiting lecturers. Including Art and Common Space

c) ***Tutorials*** offered by all Professors and guest tutors, minimum 2 tutorials with main tutor per term

In the 2nd semester, MFA master's students are to complete "Experts in Team", which is a compulsory course.

Semester structure, 3rd semester

a) ***MFA course*** – theory and practice / mandatory Presentation and articulation of project development / including thesis formulation. Thesis development and project articulation with the support of advises by all teachers.
b) In this term the 2 MFA student will have to develop their documentation of work in form of a portfolio and / or website.

b) ***Tutorials*** offered by all Professors and guest tutors, minimum 2 tutorials with main tutor per term.

Semester structure, 4th semester

a) ***MFA course*** – theory and practice / mandatory with focus on the articulation and communication of project ideas to support the artistic development of the MFA student. In this course research / theory is addressed as much as studio practice to learn to contextualize and to examine ones project / work within historic and contemporary parameters of cultural productions.

Realization of MFA project and thesis advised by several teachers including teacher from MFA course, Art & Common Space and Contact teacher.

In this term the 2 MFA student will have to collaborate together on Exhibition Design, Catalogue Production (digital or analogue)

At the end of the term the students participate in the MFA Exhibition (venues vary) and defend their works in front of 2 x teachers of KiT (one is the contact teacher) 2 x External Reviewers (one cross-disciplinary from NTNU / one external from the fields of Visual Arts)

b) ***Production*** of Catalogue and preparation of Seminar or side Program

c) ***Tutorials*** offered by all Professors and visiting tutors, minimum 2 tutorials with main tutor per term

Art and Common Space is an interdisciplinary project for art and architecture students, which explores the relationship between

art and public spaces through presentations, discussions, and practical projects.

The subject is comprised of studies of art and architecture in the production of common/public space, both in physical, philosophical, and psychological terms. As well as examining traditional public spaces there is another dimension to the course in that it attempts to re-think common space/temporality in new and experimental ways. Each semester a particular topic is chosen through which to make enquiries: for instance ‘nature’, ‘science’,’ collaborations’, ‘futurity’ etc. The aim is to generate meeting grounds between architecture and art students contributing to a deeper understanding of the specific qualities and aesthetic demands within both fields.

3. Contact information for the program

For information about the program, see http://www.ntnu.edu/studies/mfa

4. Admission requirements

For admission to the MFA program, qualifications equivalent to a Bachelor of Fine Art are required. This means that the applicant
has developed independent artistic activity at the time of admission. Applicants are evaluated based on submitted documentation
of artistic works and a written motivation or project description for the program of study.

Deadline for applications 1 February

5. General regulations regarding course options / individual education plan

For students who are admitted to programs of study consisting of 60 credits or more, an individual education plan must be drawn
up between the student and the Faculty by the end of the first semester. An individual education plan is a mutual agreement
between the individual student and NTNU. The deadline for confirmation of the individual education plan is 15 September for the
autumn semester and 15 February for the spring semester. Selection of courses for each year of study takes place electronically
through registration of the individual education plan on Student Web.

6. Deadlines

General deadlines for the academic year

15 September Deadline for confirmation of the individual education plan in the autumn semester and registration for examinations – for students in the first and third semester – compulsory participation in "Open Academy" with subsequent group review.

15 February Deadline for confirmation of the individual education plan in the spring semester and exam registration –
2nd semester – compulsory participation in semester exhibition with subsequent group review. 4th semester Participation in
MFA exhibition.

7. Experts in Team

The aim of the interdisciplinary project course Experts in Teamwork (EiT) is to prepare students for interdisciplinary cooperation in
professional life. Students will be given training in applying their specialized knowledge to professional challenges in society. Students will develop insight, skills and attitudes enabling the student team to communicate professionally and solve an interdisciplinary problem. Each student enters the teamwork as an expert in his or her field of expertise. Through teamwork, students will develop insight into their own academic competence and team behavior, and will be able to use this insight in cooperation with others. Experts in Team (EiT) is compulsory.
More information about Experts in Team is available at the website for the course: http://www.ntnu.edu/eit

8. Master's Exhibition

The MFA program ends with an exhibition with a catalogue and Internet presentation.

9. Exchange program

It is possible to apply for an exchange program in the spring semester of the first year.

For more information about studying abroad during the exchange program, see http://www.ntnu.no/studier/studier_i_utlandet or contact the administration at KIT.

10. Academic Calendar 2014-2015

Before each semester, a provisional semester schedule is posted on our website www.kit.ntnu.no

Autumn semester

Enrolment ceremony	12 August
First common information meeting	25 August
Open Academy - semester examination	11- 14 December
Review – semester examination	8, 9 and 10 December

Weekly timetables are prepared in time for the information meetings at 10:00 every Monday. All students are expected to attend these meetings.

Spring semester

Starting date	2 January
First common information meeting	5 January
Semester exhibition with review	week 19
BFA Exhibition Opening	23 April to 10 May
MFA exhibition Opening	16 May to 7 June

Weekly timetables are prepared in time for the information meetings at 1000 every Monday. All students are expected to attend these meetings.

LIST OF SUBJECTS – MASTER OF FINE ART 2014/2015

1ST YEAR

Sem	Subject no.:	Subject		autumn	spring	Sum
Autumn alternative 1						
1. sem	BK3150	Advanced Artistic Work 1A		30		30
Autumn alternative 2						
1. sem	BK3161	Advanced Artistic Work 1C		7,5		7,5
1. sem	BK3171	Art and Common Space - Theory I		7,5		7,5
1. sem		Elective course		15		15
Spring alternative 1						
2. sem	BK3250	Advanced Artistic Work 2 A			22,5	22,5
2. sem		EiT *			7,5	7,5
Spring alternative 2						
2. sem	BK3221	Art and Common Space – Theory 2			7,5	7,5
2. sem		Elective course			15	15
2. sem		EiT *			7,5	7,5

2nd year

Autumn alternative 1						
3. sem	BK3355	Advanced Artistic Work 3A		30		30
Autumn alternative 2						
3. sem	BK3361	Advanced Artistic Work 3C		7,5		7,5
3. sem	BK3371	Art and Common Space - Theory 3		7,5		7,5
3. sem		Elective course		15		15
4. sem	BK3400	Advanced Artistic Work 4			30	30

Elective courses - Master of Fine Art

1. sem	BK3130	Advanced Artistic Work 1B		15		15
1. sem	BK3170	Art and Common Space 1		15		15
2. sem	BK3260	Advanced Artistic Work 2B			15	15
2. sem	BK3220	Art and Common Space 2			15	15
3. sem	BK3360	Advanced Artistic Work 3B		15		15
3. sem	BK3370	Art and Common Space 3		15		15

MASTER OF SCIENCE IN BIOTECHNOLOGY

Gradsnavn: Master of Science in Biotechnology
Programme code: MSBIOTECH

The 2-year biotechnology Master of Science study is interdisciplinary at several levels. First, the programme is a collaboration between the Department of Biology and the Department of Biotechnology. The courses within the programme reflect this interdisciplinary, as the development of knowledge and skills is focusing on thorough knowledge about basic biological processes, available technologies to study such processes, and knowledge-based approaches to modify or optimise processes in order to tackle major societal, environmental or sustainability problems.

Learning outcomes
MSc Biotechnology, Learning Objectives

As a MSc student in Biotechnology you get bio molecular knowledge and analytical skills at an advanced level. The program emphasises advanced biochemical and biological studies. You will acquire the skills to qualify for a broad range of positions in research, industry, consultancy, education and public administration, or for further education in a doctoral program. You can in your thesis address a broad range of fields including Molecular biology, Systems biology, biopolymer chemistry, marine biochemistry, environmental biotechnology, food science, microbiology, microbial genetics, molecular biology and systems biology depending on your background and interests.

Knowledge
The MSc graduate in Biotechnology has:

- Knowledge of the leading edge in a chosen specialized area of biotechnology, based on own research experience from a master's project and international literature.
- State of art knowledge about various methodological and analytic approaches that are used within the specialization.
- In-depth knowledge in the chemical structure and function of biomolecules, metabolism in the cell, knowledge of the concepts of molecular genetics and biosynthesis of proteins, and a good theoretical and practical insight into methods used to obtain this knowledge.
- Knowledge of the relationship between structure and function at organ and/or organism level, of important cell biological communication principles and processes, and how they are regulated.

Proficiency/Skills
The MSc graduate in Biotechnology:

- Is able to independently carry out a complete scientific work process, including the understanding of theoretical background, hypothesis generation, collection and analysis of data, and interpretation and presentation of results.
- Has high competence and multidisciplinary project experience within selected topics related to biotechnology and ability to contribute in a multidisciplinary team.
- Is able to evaluate methods and results within the field of specialization critically.
- Is able to evaluate and apply relevant theory, methods and analytic approaches within the specialized field of biotechnology, including statistical methods.
- I s able to analyze relevant issues in cell and molecular biology Implement knowledge from several research fields and disciplines.

General competence
The MSc graduate in Biotechnology

- Can assess and predict the technological, ethical and social effects of their own work /disciplines and of biotechnology in general.
- Acknowledges health, safety and environment (HSE) issues in handling chemicals and biological materials; understands the environmental impacts associated with the activity; performs risk assessments and is familiar with safety instructions in his/her subject area.
- Is able to work both independently or in groups on complex projects that require collaboration across disciplines.
- Can communicate scientific results to the general public and experts by writing well-structured reports and contributions for scientific publications and posters, and by oral presentations.

Admission requirements
One of the following requirements has to be fulfilled to qualify for admission to the programme

- BSc in cell- and molecular biology,
- BSc from Norwegian university colleges within bioengineering (bioingeniørfag)
- BSc in food technology (matteknologi/næringsmiddelfag),
- An education which corresponds to 3 years of study at university level within the field of biotechnology or biochemistry.
- BSc in other related areas may be considered on an individual basis.

Study plan
There are two main components in the Master's programme:

- Master's thesis (60 ECTS credits)
- Theoretical and methodological courses, compulsory and optional courses (60 ECTS credits)

Semester	7,5 ECTS	7,5 ECTS	7,5 ECTS	7,5 ECTS
4. Spring	**BI3091/ BT3091 Special Syllabus**	Master thesis		
3. Autumn	**BI3016 Molecular Cell Biology**	Master thesis		
2. Spring	**Experts in Teamwork**	Optional course	Master thesis	
1. Autumn	**TBT4145 Molecular Genetics**	Optional course	Optional course	Optional course

Compulsory courses (30 ECTS credits):

- TBT 4145 Molecular Genetics
- Experts in Teamwork
- BI3016 Molecular Cell Biology
- BI3091/ BT3091 Special Syllabus (BI3091 Special syllabus exam (and similar special curriculum courses) can be held together with the final master exam or at an earlier stage in the master programme.)

At least two of the following courses must to be selected from the following list:
Autumn:
BI3013 Experimental Cell- and Molecular Biology 7,5 ECTS
BI3019 System biology; Resources, Standards, Tools 7,5 ECTS

TBT4135 Biopolymers	7,5 ECTS
TBT4505 Biotechnology Specialization Course	7,5 ECTS
BI3071 Advanced Ecotoxicology	7,5 ECTS
BI3072 Environmental toxicology	7,5 ECTS
BI3075 Experimental toxicology	7,5 ECTS
BI2014 Molecular Biology	7,5 ECTS
BI2015 Molecular Biology, lab.course	7,5 ECTS
BI2021Plant Ecophysiology	7,5 ECTS
BI2022 Plant growth and Development	7,5 ECTS

Spring:

BI3018 Patentation and Commercialization of Biotech and Medtech Invention,	7,5 ECTS
TBT4125 Food Chemistry	7,5 ECTS
TBT4130 Environmental Biotechnology	7,5 ECTS
TBT4165 Systems Biology and Biological Networks	7,5 ECTS
BI3073 Genetic toxicology	7,5 ECTS
BI2012 Cell Biology	7,5 ECTS

All other courses at master level can be chosen, but are not planned according to fit in the programme (timetable and examination date)
Examples of relevant courses are listed below:

FI3107 Biotechnology and Ethics	7,5 ECTS
MOL3005 Immunology	7,5 ECTS
MOL3014 Nanomedicine I: Bioanalysis	7,5 ECTS
MOL3015 Nanomedicine II: Therapy	7,5 ECTS
MOL3019 Applied Bioinformatics	7,5 ECTS

The normal workload for a full-time student for one academic year is 60 ECTS credits.
The programme also offers the students the opportunity to study one semester abroad. We recommend that this is done in the 2nd semester (application deadline 1.st October). At least 3 of the courses taken during the master's degree have to be NTNU courses. At least 30 ECTS, in addition to the course Experts in Teamwork, should be covered by courses on a master level. Deadline for handing in the Master thesis is the 15th of May; deadline for the exam is 15th of June in the 4th semester.

Master Thesis
The Department of Biology and the Department of Biotechnology will give the student opportunities to choose between wide varieties of master thesis, covering various aspects from human health to food chemistry. In this way the programme ensures that all students, despite various educational backgrounds, are given suitable master thesis that connect to and builds directly on their previous education.

Master's thesis can be linked to on-going research in Molecular Biology, Biopolymer chemistry, Microbiology and Molecular Genetics, Systems Biology, Bioinformatics, Microarray-based and other genomics data production technologies, knowledge gathering and modelling of biological processes, Food Chemistry, and Environmental Biotechnology.

The student will be part of active research groups working with research themes that include the analysis of basic developmental processes and biochemical processes in plants; characterization of marine algae to lay the foundation for biotech applications in the fields of energy production, CO_2 capture, materials and feed; the study of fundamental processes that link quality of food and human metabolic health; the exploitation of software tools and

knowledge bases to integrate and simulate biological processes in the computer; the use of microbial communities for production of renewable energy and for water treatment; molecular genetics and biochemistry of antibiotic biosynthesis in marine bacteria and genome-based bioprospecting for new antibiotics; structure-functional characterization of bioactive molecules derived from bioprospecting studies; quality of food linked to the biochemical processes in the raw material and changes during storage and processing.

Career prospects
Graduates of the Masters programme will be internationally qualified for a wide range of positions both in industry and research related to bio- and medical technology, as well as for further doctoral studies. Other areas of employment are in the biotechnological and pharmaceutical industry, i.e. in connection with development of therapeutic products, methods of analysis and kits, along with improving products in agriculture and aquaculture.
A number of students, mainly former Bioengineers, have got leading positions in laboratories, or they are teachers in Medical technical teaching institutions. After graduating, all the students independent of their educational background, are qualified for a wide range of positions in public and government institutions, in research positions or research support in universities and private research institutes, hospitals and government institutions like Folkehelsa, Veterinærinstituttet and Næringsmiddeltilsynet, and they also have competence within the area of risk assessment (REACH).

A) Information about the Master's Study

Workload and Structure

The programme requires two years of full-time study, beginning with the autumn term (medio August). The normal work load for a full-time student for one academic year is 60 ECTS credits.

The Master's study consists of two parts:

1. A written thesis of the project (Master's thesis). The extent of the assignment should correspond to a work load of 60 credits. The work on the thesis is time limited. The thesis has to be handed in within May 15th of the 2nd year.
2. An approved selection of courses, of a minimum of total of 60 credits, from what (at least) 30 credits must be courses at 3000-level (master level) (UTF§14.1).

Master's agreement

Every master student has to make a Master's agreement. This agreement comprises your syllabus and master project together with regulations for the counseling given during the master's study. The subjects, compulsory or elective, stated as syllabus in your Masters Agreement cannot be changed. If there for serious reason develops a need for change, the Masters Agreement must be revised. The supervisor, the responsible institute and the student must agree upon the revision and the new Agreement filed.

The Master's thesis

The Master thesis should be developed as your own original work (with some support from your adviser). Any quotation, use of data, information etc. from other sources (including the scientifically literature and your fellow students) should therefore be carefully listed and included in the reference list of your thesis, according to best practice within your field of study.

Submission and Examination

The student has to:

- Register for the final master's degree exam (through STUDWEB) within February the 15th of the 2nd academic year
- Apply for approval of your individual special syllabus if your Masters Agreement demands a special syllabus. It is important that this is done well in advance of the examination. A study committee will evaluate the syllabus, and if it is not accepted, you must change it. Your supervisor must approve and sign the form. The syllabus should be a minimum of 50 pages per credit.
- Hand in the thesis (within the deadline given, see below) for print through DAIM .The Department will give you 5 copies of the thesis.

In addition to the judgment of thesis, the candidate will have an oral exam consisting of:

1) A conversation on/presentation ("defense") of the research assignment (the master's thesis)

2) Examination on the theoretic syllabus of the advanced subjects which has previously not been evaluated during the study (at least 7,5 credits, preferentially individual special syllabus). All exams, except the Individual Special Syllabus (if any) have to be passed before the date of the final Master's Degree exam, unless otherwise stated in your Masters Agreement.

A grade is given for every course / special syllabus that constitutes a part of the exam.

Important deadlines

- **15th of October (1st year)**: Decide on a Master's project in cooperation with a supervisor.
- **1st of November** (1st year) Register your Master's Agreement in DAIM and hand in the project description.
- **15th of February (2nd year):**Deadline for the signing up of the final Master's Degree exam (through STUDWEB)
- **15th of May (2nd year)**. Deadline for the submission of the master thesis. If the thesis is not submitted within this date the grade "not passed" will be awarded, unless there is an application for extension of the deadline in reasonable time before the deadline. The reasons given in the application must be in accordance with Supplementary Regulations for the Natural Sciences (UTF) § 20.3 and the Examination Regulations at NTNU, § 20. The Supplementary Regulations for the Natural Sciences (UTF) § 7 and the Examination Regulations at NTNU, § 7. See below for further information regarding §7 and §23.3.
- **15th of June (**approximately**, 2nd year)**: The date for the final Master's Degree exam. (Individual agreement with the respective Department, approximately four weeks after the thesis is submitted).

Leave of absence from the Master Study (UTF § 7) (extract):

a) Leave of absence from the master studies of two years of duration and from the two last year of master studies of five years of duration is normally not granted.
b) Leaves of absence may nevertheless be granted when applied for and compelling circumstances are present. Such circumstances might be illness (yourself or among close family member) etc.

Prolongation of the study (UTF § 20.3) (extract):
The master's thesis is time limited. In case of illness, the deadline for handing in the thesis can be postponed equivalent to the time of absence due to illness. The illness must be documented by medical certificate.

If there is a valid reason for not handing in the thesis in time, one can apply for up to three months prolongation of the deadline. If the thesis is not handed in within the extended deadline, a new extension must be applied for, or else the candidate is regarded failed. Delay of deadline can only be applied for twice.

Valid reasons for postponement (in addition to illness) is teaching, organized student activity, social work and unmerited problems concerning the thesis. Written documentation or statement is required, in addition to a new plan of completion. The Faculty, or Department when given the assignment by the Faculty, determines the application. When the reason for delay is teaching, organized student activity or social work, the extended time given is according to the time spent on these activities.

The agreed delay has no influence on the evaluation of the thesis.

MSc-Programme in Biology
(Including educational cooperation with Nordic Academy of Biodiversity and Systematic Studies (Nabis))
Grade name: 'Master of Science in Biology'
Programme code: MSBIO

***Course* descriptions:**

MSc in biology has four **specializations***:*
• Cell and Molecular Biology
• Physiology
• Ecology, Behaviour, Evolution and Biosystematics
• Biodiversity and Systematics (Nabis)

The specializations are different in terms of compulsory subjects for admission.

The master-degree study has two main components

• Master- thesis (60 credits)
• Theoretical and methodological courses, required and elective courses (60 credits)

A general condition of a 'MSc in Biology' is two years of full-time study where the normal workload for a full-time student for one academic year is 60 credits. Teaching is given in English for all four study areas.

Learning outcomes 'MSc in Biology':

General outcome for all students:

The master-program in Biology provides candidates with research-based, specialized knowledge. Practical projects provides skills and general competence at an advanced level, with the aim of working in research, manufacturing, consulting, education and public administration or for further education in a doctoral program. The Msc-thesis provides expertise in one of the research areas: Cell and molecular biology, physiology, ecology, behavior, evolution and biosystematics

Master candidate shall have acquired upon complete education:
Knowledge
• Have expertise and research experience in selected topics in biology, some of these supporting the master project.
• Have a thorough knowledge to the various labor and analytical methods used in the field.
• Have a thorough knowledge to the extent of research being conducted in biology today.
• Have a thorough knowledge and experience of current work- and analyze-methods.

Skills
• An experience of written and oral presentations of own research results to specialists and to a broader audience.
• Be able to combine knowledge from multiple disciplines.
• Be able to work with deadlines in relation to a larger project.
• Be able to update themselves on the scientific knowledge of their specialization.

General competence
• Be able to critically evaluate scientific work including methods and results.
• Be able to independently carry out a scientific project from initial hypotheses, collecting and analyzing data to an oral and written report in scientific format.

• Be able to obtain and evaluate research information.
• Be able to work in projects, both independently and in collaboration with others, including interdisciplinary teams.
• Be able to analyze key issues within their specialization.
• Be able to communicate extensive scientific work.
• Be able to contribute to innovation within their specialization.
• Have knowledge and experience in risk analysis and management of chemical and biological materials and understand the environmental consequences of these, with a focus on health, safety and environment (HSE).
• Be able to communicate written and orally and in English about academic matters.

Learning outcome for individual study specializations:
Specialization: Cell and Molecular Biology
The specialization will provide deep molecular understanding of cell biological mechanisms and their regulation. After completing the program, the candidate should have good knowledge of the main methods in cell and molecular biology and the use of modern experimental techniques and apparatus. A scientific investigation is conducted with subsequent written presentation within a particular topic. The candidate shall here display technical expertise and ability to critically evaluate scientific work.

Master candidate shall upon complete education:
Knowledge
• Have advanced research based knowledge of important biological cell-communication principles and processes and how they are regulated.
• Have advanced knowledge of the cell and molecular biology area.
• Have applied knowledge in cell and molecular biology.

Skills
• Be able to use and master important techniques to perform independent laboratory work and conduct an independent scientific investigation.
• Can use cell and molecular biological methods in a research paper and give a written presentation of research results.
• Ability to apply existing theories in cell and molecular biology.

Specialization: Physiology
The specialization provides insight into how animals and plants function in their natural environment. Candidates will acquire thorough understanding of the relationship between specific factors in the external environment and physiological characteristics. A scientific survey is conducted with subsequent written presentation within a particular topic. Here, the candidates should show professional expertise and ability to critically evaluate scientific work.

Master candidate shall upon complete education:
Knowledge
•Have up-to-date scientific knowledge of how animals and plants function in their natural environment and have acquired a thorough understanding of the relationship between specific factors in the external environment and physiological characteristics.
• Have a thorough knowledge of the field of physiology.
• Be able to analyze and solve physiological problems.

Skills
• Be able to master important methods (in field and/or laboratory) and to conduct an independent scientific investigation and subsequent written presentation within a particular topic.

• Be able to analyze theories of physiology.

Specialization: Ecology, Behaviour, Evolution and Biosystematics
The specialization provides a thorough introduction to one of the fields: ecology, behaviour, evolution and biosystematics. Considering the special field, courses will provide a thorough introduction to living organisms' relation to the environment and other living organisms, both within and between species. Specialization gives understanding of micro-and macro-evolutionary processes, and methods used to study them, including methods based on morphological and molecular characters.

Master candidate shall upon complete education
Knowledge
• Have new knowledge on theoretical and / or experimental aspects of the specialty and broad knowledge in nearby fields.
• Have a thorough knowledge of how biology can yield understanding and solutions to environmental problems.
• Have deep knowledge about biodiversity.
• Be able to understand the evolutionary history and ecological processes.

Specialization: Biodiversity and Systematics
The specialization provides a thorough introduction to biodiversity and systematics including identification skills in one or more groups of organisms. The program will provide an overview of living organisms and kinship / classification between them, species formation and evolutionary history and processes underlying diversity patterns, as well as knowledge about the rules for naming of species. A scientific investigation is conducted in a particular subject with subsequent written presentation. Here, the candidates should show professional expertise and ability to critically evaluate scientific work.

Master candidate shall upon complete education:
Knowledge
• Have advanced knowledge and understanding of theories related to the fields of biodiversity and systematics and specialized knowledge in a defined area.
• Extensive knowledge of current research and practice in methodology of biodiversity and systematics.

Skills
• Be able to describe the evolutionary mechanisms that lead to speciation.
• Be able to explain species concept and be able to produce and critically analyze molecular data.
• Be able to assess their own work critically and thereby contribute to knowledge in the field.

General competence
• Understand the importance of biodiversity in a global perspective and understanding of ethical and economic aspects related to the conservation of biological diversity.
• Show awareness of ethical issues in relation to research and management practices within the specialization.

Curriculum for the specializations (see table below):
• **Cell and Molecular Biology**
• **Physiology**
• **Ecology, Behaviour, Evolution and Biosystematics**

Semester	7,5 ECTS	7,5 ECTS	7,5 ECTS	7,5 ECTS
4. Spring	BI3091 Special Syllabus			
3. Autumn	Optional course	Optional course		
2. Spring	Experts in Teamwork	Optional course		
1. Autumn	Optional course	Optional course	Optional course	

• **Cell and Molecular Biology:**
The compulsory courses for the specializations are:
Experts in teamwork, spring
BI3016 Molecular and Cell Biology, autumn
BI 3091 Special Syllabus BI3091 Special syllabus exam (and similar special curriculum courses) can be held together with the final master exam or at an earlier stage in the master programme.

In addition we recommend the following courses
Autumn:

BI 3013 Experimental Cell- and Molecular Biology	7,5 ECTS
BI3019 System biology; Resources, Standards, Tools	7,5 ECTS
TBT4135 Biopolymers	7,5 ECTS
BI3071 Advanced Ecotoxicology	7,5 ECTS
BI3072 Environmental toxicology	7,5 ECTS
BI3075 Experimental toxicology	7,5 ECTS
BI2021 Plant Ecophysiology	7,5 ECTS

Spring:

BI3018 Patentation and Commercialization of Biotech and Medtech Invention,	7,5 ECTS
TBT4125 Food Chemistry	7,5 ECTS
TBT4130 Environmental Biotechnology	7,5 ECTS
TBT4165 Systems Biology and Biological Networks	7,5 ECTS
BI3073 Genetic toxicology	7,5 ECTS

Courses from The Medical Faculty can also be chosen, but are not planned according to fit in the programme (timetable and examination date).

• **Physiology**:
The compulsory courses for the specializations are:
Experts in teamwork,
BI3021 Ecophysiology or BI3020 Advanced physiology
BI 3091 Special Syllabus BI3091 Special syllabus exam (and similar special curriculum courses) can be held together with the final master exam or at an earlier stage in the master programme.

In addition we recommend the following courses

BI2022 Plant growth and Development	7,5 ECTS
BI2021Plant Eco Physiology	7,5 ECTS
BI2014 Molecular Biology	7,5 ECTS
BI2012 Cell Biology	7,5 ECTS
BI2015 Molecular Biology, lab.course	7,5 ECTS
BI3016 Molecular Cell Biology	7,5 ECTS
BI3019 Systems Biology: Resources, standards and tools,	7,5 ECTS

BI3020 Advanced Physiology	7,5 ECTS
BI3071 Advanced Ecotoxicology	7,5 ECTS
BI3072 Environmental Toxicology	7,5 ECTS
BI3073 Genetic Toxicology	7,5 ECTS

Courses from The Medical Faculty can also be chosen, but are not planned according to fit in the programme (timetable and examination date).

• **Ecology, Behaviour, Evolution and Biosystematics;**
The compulsory courses for the specializations are:
Experts in teamwork,
BI3081 Scientific Seminars,
BI 3091 Special Syllabus; BI3091 Special syllabus exam (and similar special curriculum courses) can be held together with the final master exam or at an earlier stage in the master programme.

At least two of the courses (*In addition we recommend the courses)*:
BI3010 Population Genetics,
BI3036 Plant Ecology,
BI3037 Freshwater Ecology,
BI3040 Behavioural Ecology,
BI3051 Evolutionary Analysis,
BI3082 Biodiversity and Conservation Biology II,
BI3083 Evolutionary and Ecological Genetics,
BI3084 Conservation Biology,

Curriculum for the specialization (see table below):
• **Biodiversity and Systematics (Nabis)**

	5 ECTS	5 ECTS	5 ECTS	5 ECTS	5 ECTS	5 ECTS
4. Spring	Master thesis					
3. Autumn	Master thesis					
2. Spring	Optional courses					
1. Autumn	Alpha taxonomical principles (UiO, compulsory)	Fundamental and molecular systematics (Uppsala U, compulsory)		Optional courses		

Nabis is a Nordic education cooperation where students take all their courses in master Nabis program and students are therefore exempted from the 'Experts in team'. Participation in Nabis will involve exchange and obligations at the various institutions. Participation in Nabis will give students at this program access to a course portfolio in biosystematics with advanced courses in floristics and faunistics, topics in taxonomic classification for different groups of organisms, theoretical systematics, evolutionary biology and phylogeography, bioinformatics and molecular biology. Nabis program currently offers 24 courses that are categorized as follows:

• biodiversity identification (9 courses each 5 ECTS)
• biodiversity classification (6 courses each 10 ECTS)
• systematic theory (3 courses each 10 ECTS)
• tools and skills (6 courses each 5 ECTS)

Students are required to take at least one course in each of the categories above. For course overview, see http://www.nabismaster.org/courses.php. The courses are given at NTNU, University of Oslo, University of Tromsø, Gothenburg University, Stockholm University, Lund University, Uppsala University, Aarhus University and University of Copenhagen. Theory courses are mainly e-learning organized, but may include meetings with practical elements or intensive laboratory part which require attendance at the course location. An example is the compulsory course 'Fundamental and Molecular Systematics' which starts with two weeks of intensive laboratory component at a biological station in the beginning of the first semester. Attendance at the course location also applies to field-courses.

Admission requirements:
The same entry requirements apply as for other graduate degrees: the Bachelor of Science in Biology (180 ECTS) or equivalent. The various specializations will have slightly different requirements for subjects completed in biology bachelor's degree.

Career prospects
Graduates in Biology are employed in research, private industry, government and education in Norway and internationally. NTNU is together with University of Oslo and Bergen educating most of the master students in biology in Norway. A survey recently conducted by the Department of Biology, NTNU e shows that 40% of master's graduates from this biology Department get jobs before the end of the study. Three months after finished the master's exam, over 65% have gained relevant work. The market for graduates is likely to increase because of environmental challenges.

A) Information about the Master's Study

Workload and Structure
The programme requires two years of full-time study, beginning with the autumn term (medio August). The normal work load for a full-time student for one academic year is 60 ECTS credits.

The Master's study consists of two parts:

3. A written thesis of the project (Master's thesis). The extent of the assignment should correspond to a work load of 60 credits. The work on the thesis is time limited. The thesis has to be handed in within May 15th of the 2nd year.
4. An approved selection of courses, of a minimum of total of 60 credits, from what (at least) 30 credits must be courses at 3000-level (master level) (UTF§14.1).

Master's agreement
Every master student has to make a Master's agreement. This agreement comprises your syllabus and master project together with regulations for the counseling given during the master's study. The subjects, compulsory or elective, stated as syllabus in your Masters Agreement cannot be changed. If there for serious reason develops a need for change, the Masters Agreement must be revised. The supervisor, the responsible institute and the student must agree upon the revision and the new Agreement filed.

The Master's thesis
The Master thesis should be developed as your own original work (with some support from your adviser). Any quotation, use of data, information etc. from other sources (including the scientifically literature and your fellow students) should therefore be carefully listed and

included in the reference list of your thesis, according to best practice within your field of study.

Submission and Examination

The student has to:

- Register for the final master's degree exam (through STUDWEB) within February the 15th of the 2nd academic year
- Apply for approval of your individual special syllabus if your Masters Agreement demands a special syllabus. It is important that this is done well in advance of the examination. A study committee will evaluate the syllabus, and if it is not accepted, you must change it. Your supervisor must approve and sign the form. The syllabus should be a minimum of 50 pages per credit.
- Hand in the thesis (within the deadline given, see below) for print through DAIM .The Department will give you 5 copies of the thesis.

In addition to the judgment of thesis, the candidate will have an oral exam consisting of:

- A conversation on/presentation ("defense") of the research assignment (the master's thesis)

Examination on the theoretic syllabus of the advanced subjects which has previously not been evaluated during the study (at least 7,5 credits, preferentially individual special syllabus). All exams, except the Individual Special Syllabus (if any) have to be passed before the date of the final Master's Degree exam, unless otherwise stated in your Masters Agreement.

A grade is given for every course / special syllabus that constitutes a part of the exam.

Important deadlines

- **15th of October (1st year)**: Decide on a Master's project in cooperation with A supervisor.
- **1st of November** (1st year) Register your Master's Agreement in DAIM and hand in the project description.
- **15th of February (2nd year):**Deadline for the signing up of the final Master's Degree exam (through STUDWEB)
- **15th of May (2nd year)**. Deadline for the submission of the master thesis. If the thesis is not submitted within this date the grade "not passed" will be awarded, unless there is an application for extension of the deadline in reasonable time before the deadline. The reasons given in the application must be in accordance with Supplementary Regulations for the Natural Sciences (UTF) § 20.3 and the Examination Regulations at NTNU, § 20. The Supplementary Regulations for the Natural Sciences (UTF) § 7 and the Examination Regulations at NTNU, § 7. See below for further information regarding §7 and §23.3.
- **15th of June (**approximately**, 2nd year)**: The date for the final Master's Degree exam. (Individual agreement with the respective Department, approximately four weeks after the thesis is submitted).

Leave of absence from the Master Study (UTF § 7) (extract):

c) Leave of absence from the master studies of two years of duration and from the two last year of master studies of five years of duration is normally not granted.
d) Leaves of absence may nevertheless be granted when applied for and compelling circumstances are present. Such circumstances might be illness (yourself or among close family member) etc.

Prolongation of the study (UTF § 20.3) (extract):

The master's thesis is time limited. In case of illness, the deadline for handing in the thesis

can be postponed equivalent to the time of absence due to illness. The illness must be documented by medical certificate.

If there is a valid reason for not handing in the thesis in time, one can apply for up to three months prolongation of the deadline. If the thesis is not handed in within the extended deadline, a new extension must be applied for, or else the candidate is regarded failed. Delay of deadline can only be applied for twice.

Valid reasons for postponement (in addition to illness) is teaching, organized student activity, social work and unmerited problems concerning the thesis. Written documentation or statement is required, in addition to a new plan of completion. The Faculty, or Department when given the assignment by the Faculty, determines the application. When the reason for delay is teaching, organized student activity or social work, the extended time given is according to the time spent on these activities.

The agreed delay has no influence on the evaluation of the thesis.

B) Programme Specific Regulations

Department of Biology:

“BI3091 Special syllabus exam (and similar special curriculum courses) can be held together with the final master exam or at an earlier stage in the master programme.”

MSC PROGRAMME IN MARINE COASTAL DEVELOPMENT

This Master of Science degree program in Marine Coastal Development is an integrated, two year study program for Norwegian and foreign students. The program is designed according to the current framework for engineering and science graduate studies at NTNU. The normal workload for a full-time student for one academic year is 60 credits.

The program is especially designed to give the students a broad understanding of the complex interactions in the coastal zone and how human activity affects this environment.

Admission

Entry requirement to this MSc program is a Bachelor degree (or equivalent) in Science or Engineering with an academic profile in marine science. Norwegian students can enter the full M.Sc. programme, or select individual courses from the program in their study curriculum. Foreign students can be admitted through the Quota Program, with participants from developing countries and from Central and Eastern Europe. Students with other sources of financing may also be admitted to the full MSc program. Foreign exchange students can select individual courses from the program, provided they have the necessary qualifications for the courses.

Learning objective

Objective of the Master's program in MSc in Marine Coastal Development

MSc in Marine Coastal Development provides students with knowledge, analytical skills and general knowledge at an advanced level, with the aim of working in universities, independent institutes, industry, consultancy, manufacturing, equipment, school sector and public administration, or for the purpose of further education in a doctoral degree program.

The Master of Science degree program provides an interdisciplinary, broad understanding of complex interactions in the marine environment. The oceans have large marine living and non-living resources that are becoming increasingly important, and that we will be more dependent of in the future. In order to utilize and conserve resources and develop coastal resources in a sustainable manner, there is a need for in-depth knowledge, interdisciplinarity, in both economy, environment, technology, marine biological resources, and other social developments.

The thesis provides special expertise in the areas of research: 1. Aquaculture, 2. Marine Harvesting 3. Marine Biology and Biochemistry

Knowledge

The candidate has

- Solid knowledge of marine technology, marine biology or aquaculture and advanced knowledge in a variety of topics, some of which support the thesis
- Depth knowledge in the form of research experience in their field, through a supervised master's project
- Knowledge of the breadth of research conducted in the marine sciences today
- Interdisciplinary, broad understanding of complex interactions in the marine environment.
- Knowledge of different working and analytical methods used in the field.

Skills

The candidate

- has background and experience to formulate and analyze complex bioscience research or technological problems
- Manages a variety of advanced theoretical and experimental methods in their fields.
- Can make critical and independent assessments of methods and results

- Can design, implement and report a scientific project both through teamwork and independent in the thesis
- Can communicate technical material and the results both to specialists and to a wider audience
- Can combine insights from several disciplines

General competence
The candidate
- Knows how the marine sector and its operations have evolved as a discipline / science, also internationally.
- Is able to acquire, evaluate and use relevant and reliable new information, and thus renew and further develop their professional skills
- Has knowledge of the marine sector's role in society and is the basis for assessing the ethical issues
- Has expertise in handling chemical substances and biological materials and understand environmental problems, focusing on health, safety and environment (HSE)

Specializations

The following three lines of specializations are offered: The students have to choose one of them. Deadline 15th October 1st semester.

□□□Aquaculture

Marine Juvenile Technology –60 credits thesis possible
Contact: Professor Elin Kjørsvik

Marine Aquaculture system - Both 30 and 60 credits thesis possible
Contact: Professor Yngvar Olsen – 60 credits thesis
Professor Harald Ellingsen – 30 credits thesis

Recycling Aquaculture and Environmental Analysis -30 credits thesis possible
Contact: Professor Tor Ove Leiknes

□□□ Marine Harvesting

Processing of Marine Resources - Both 30 and 60 credits thesis possible
Contact: Professor Turid Rustad – Both 30 and 60 credits thesis

Sustainable Marine Harvesting - 30 credits thesis possible
Contact: Professor Harald Ellingsen

□□□Marine Biology and Biochemistry

Marine Biology and Ecology - 60 credits thesis possible
Contact: Professor Yngvar Olsen

Marine Biochemistry and Biotechnology - Both 30 and 60 credits thesis possible
Contact: Professor Kjell Morten Vaarum – Both 30 and 60 credits thesis

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Professor Kjell Morten Vaarum, Department of Biotechnology
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Compulsory courses

All students have two compulsory courses in common; TMR 4137 *Sustainable Utilization of Marine Resource, and* BI3061 *Biological Oceanography* in addition to *"Experts in Teamwork"(see below).* Every specialization has strongly recommended courses, see tables below.

Experts in Teamwork

Experts in Teamwork is compulsory.

Thesis

The thesis consists of 60 credits or 30 credits. This depends of the student's education and the chosen field of study. For instance, all students taking their thesis at the Department of Biology choose the 60 credits thesis. These students will start their work on the thesis in the 2.nd semester. Students with a former technology education taking their thesis at Department of Marine Technology or Department of Hydraulic and Environmental Engineering choose the 30 credit thesis, starting in their 4.th semester. Students at Department of Biotechnology may choose either a 30 or a 60 credits thesis.

A) Information about the Master's Study (Thesis 60 credits)

Workload and Structure

The programme requires two years of full-time study, beginning with the autumn term (medio August). The normal work load for a full-time student for one academic year is 60 ECTS credits.

The Master's study consists of two parts:

5. A written thesis of the project (Master's thesis). The extent of the assignment should correspond to a work load of 60 credits. The work on the thesis is time limited. The thesis has to be handed in within May 15th of the 2nd year.
6. An approved selection of courses, of a minimum of total of 60 credits, from what (at least) 30 credits must be courses at 3000-level (master level) (UTF§14.1).

Master's agreement

Every master student has to make a Master's agreement. This agreement comprises your syllabus and master project together with regulations for the counseling given during the master's study. The subjects, compulsory or elective, stated as syllabus in your Masters Agreement cannot be changed. If there for serious reason develops a need for change, the Masters Agreement must be revised. The supervisor, the responsible institute and the student must agree upon the revision and the new Agreement filed.

The Master's thesis

The Master thesis should be developed as your own original work (with some support from your adviser). Any quotation, use of data, information etc. from other sources (including the

scientifically literature and your fellow students) should therefore be carefully listed and included in the reference list of your thesis, according to best practice within your field of study.

Submission and Examination

The student has to:

- Register for the final master's degree exam (through STUDWEB) within February the 15th of the 2nd academic year
- Apply for approval of your individual special syllabus if your Masters Agreement demands a special syllabus. It is important that this is done well in advance of the examination. A study committee will evaluate the syllabus, and if it is not accepted, you must change it. Your supervisor must approve and sign the form. The syllabus should be a minimum of 50 pages per credit.
- Hand in the thesis (within the deadline given, see below) for print through DAIM .The Department will give you 5 copies of the thesis.

In addition to the judgment of thesis, the candidate will have an oral exam consisting of:

- A conversation on/presentation ("defense") of the research assignment (the master's thesis)

Examination on the theoretic syllabus of the advanced subjects which has previously not been evaluated during the study (at least 7,5 credits, preferentially individual special syllabus). All exams, except the Individual Special Syllabus (if any) have to be passed before the date of the final Master's Degree exam, unless otherwise stated in your Masters Agreement.

-

A grade is given for every course / special syllabus that constitutes a part of the exam.

Important deadlines

- **15th of October (1st year)**: Decide on a Master's project in cooperation with a supervisor.
- **1st of November** (1st year) Register your Master's Agreement in DAIM and hand in the project description.
- **15th of February (2nd year):**Deadline for the signing up of the final Master's Degree exam (through STUDWEB)
- **15th of May (2nd year)**. Deadline for the submission of the master thesis. If the thesis is not submitted within this date the grade "not passed" will be awarded, unless there is an application for extension of the deadline in reasonable time before the deadline. The reasons given in the application must be in accordance with Supplementary Regulations for the Natural Sciences (UTF) § 20.3 and the Examination Regulations at NTNU, § 20. The Supplementary Regulations for the Natural Sciences (UTF) § 7 and the Examination Regulations at NTNU, § 7. See below for further information regarding §7 and §23.3.
- **15th of June (**approximately**, 2nd year)**: The date for the final Master's Degree exam. (Individual agreement with the respective Department, approximately four weeks after the thesis is submitted).

Leave of absence from the Master Study (UTF § 7) (extract):

e) Leave of absence from the master studies of two years of duration and from the two last year of master studies of five years of duration is normally not granted.

f) Leaves of absence may nevertheless be granted when applied for and compelling circumstances are present. Such circumstances might be illness (yourself or among close family member) etc.

Prolongation of the study (UTF § 20.3) (extract):

The master's thesis is time limited. In case of illness, the deadline for handing in the thesis can be postponed equivalent to the time of absence due to illness. The illness must be documented by medical certificate.

If there is a valid reason for not handing in the thesis in time, one can apply for up to three months prolongation of the deadline. If the thesis is not handed in within the extended deadline, a new extension must be applied for, or else the candidate is regarded failed. Delay of deadline can only be applied for twice.

Valid reasons for postponement (in addition to illness) is teaching, organized student activity, social work and unmerited problems concerning the thesis. Written documentation or statement is required, in addition to a new plan of completion. The Faculty, or Department when given the assignment by the Faculty, determines the application. When the reason for delay is teaching, organized student activity or social work, the extended time given is according to the time spent on these activities.

The agreed delay has no influence on the evaluation of the thesis.

B) Programme Specific Regulations

Department of Biology

“BI3091 Special syllabus exam (and similar special curriculum courses) can be held together with the final master exam or at an earlier stage in the master programme.”

More information
www.ntnu.no/macodev

MSc in Marine Coastal Development (MACODEV)
1st and 2nd year Specialization 60 credits

Ex	Subject no	Subject title	Note	Cr	Specialization		
					1	2	3
		Compulsory courses					
1st sem	TMR4137	SUST UTIL OF MARINE RESOURCES		7,5	C	C	C
autumn	BI3061	BIOL OCEANOGRAPHY		7,5	C	C	C
	BI3062	SCIENTIFIC SEMINARS, MARINE		0	C	C	C
		Optional courses A-list	a				
	BI3060	EXPERIMENTAL MARINE ECOL METHODS	1,3,d	7,5	O	O	O
	BI3063	BIOLOGICAL AND GENETIC STOCK MANAGE	2,3	7,5	O	O	O
	KJ3051	OCEAN SPACE: MARINE BIOGEOCHEMICAL PROC	1,2,3	7,5	O	O	O
	TBT4135	BIOPOLYMERS	3	7,5	O	O	O
	TBT4145	MOLECULAR GENETICS	3	7,5	O	O	O
	TMR4115	DESIGN METHODS	1,2	7,5	O	O	O
	TMR4130	RISK ANALYSES AND SAFETY MANAGEMENT	1,2	7,5	O	O	O
	TMR4135	FISHING VESSEL AND WORK BOAT DESIGN	2	7,5	O	O	O
		Optional courses B-list	b				
	BI3010	POPULATION GENETICS		7,5	O	O	O
	TBT4140	BIOCHEMICAL ENGINEERING		7,5	O	O	O
	BT3110	AQUATIC FOOD PROCESSING AND TECHNOLOGY	1,2,3	7,5	O	O	O
	TIØ4120	OPERATION RESEARCH, INTRO		7,5		O	
	TMR4215	SEA LOADS	2	7,5	O	O	O
	TTT4175	MARINE ACOUSTICS		7,5	O	O	O
	TVM4145	UNIT PROC IN WATER AND WASTEWAT TREATM		7,5	O	O	O
	TEP4223	LIFE CYCLE ASSESSMENT		7,5	O	O	O
	BT3115	PRIMARY PRODUCTION – AQUACULTURE FISH	1,2,3	7,5	O	O	O
	BT3125	AQFOODSAFETY	1,2,3	7,5	O	O	O
	BT3120	AQFOOD SUPPLY CHAIN	1,2,3	7,5	O	O	O
2nd sem		**Compulsory courses**					
spring	-	EXPERTS IN TEAMWORK		7,5	C	C	C
	BI3062	SCIENTIFIC SEMINARS, MARINE		0	C	C	C
	BI3905/BT3905	MASTER THESIS IN MaCoDev		15	C	C	C
		Optional courses A-list	a				
	BI3066	MARINE JUVENILE PRODUCTION	1,d,e	7,5	O	O	O
	BI3083	EVOLUTIONARY AND ECOLOGICAL GENETICS	1,2,3	7,5	O	O	O
	TEP4265	THERMAL AND PROCESS ENGINE FOR BIOMAT	2	7,5	O	O	
	TMR4140	DESIGN OF MARINE PRODUCTIONS PLANTS	1	7,5	O	O	O
	TMR4120	UNDERWATER ENGINEERING, BC	2	7,5	O	O	
	TMR4230	OCEANOGRAHY	2	7,5	O	O	O
	TMR4225	MARINE OPERATIONS		7,5	O		O
		Optional courses B-list	b				
	SØK2004	INDUSTRIAL ECONOMICS		7,5		O	
	TBT4125	FOOD CHEMISTRY	2,3	7,5	O	O	O
	TMR4240	MARINE CONTROL SYSTEMS		7,5		O	
	TTK4170	MOD AND IDENTIFIC BIOLOGICAL SYST	1	7,5	O		
3rd sem		**Compulsory courses**					
autumn	BI3062	SCIENTIFIC SEMINARS, MARINE		7,5	C	C	C
	BI3905/BT3905	MASTER THESIS IN MaCoDev		22,5	C	C	C
4th sem		**Compulsory courses**					
spring	BI3091	SPECIAL SYLLABUS FOR MASTER DEGREE		7,5	C	C	C
	BT3092	SPECIAL SYLLABUS FOR MASTER DEGREE		7,5	C	C	C
	BI3905/BT3905	MASTER THESIS IN MaCoDev		22,5	C	C	C

Specialization 60 credits:
1. Aquaculture
2. Marine Harvesting
3. Marine Biology and Biotechnology

1) Aquaculture:
The following courses are recommended in specialization
Marine Juvenile Technology
Autumn: KJ3051, BI3060, TMR4115 Spring: BI3066, TMR4140
Marine Aquaculture Systems
Autumn: KJ3051, TMR4115 Spring: BI3066, TMR4140, TTK4170

2) Marine Harvesting
The following courses are recommended in specialization
Processing of Marine Resources
Autumn: BI3063, KJ3051 TMR4115, TMR4130, TMR4135, TMR4215, Spring: TBT4125, TEP4265, TMR4120,TMR4230

3) Marine Biology and Biotechnology:
The following courses are recommended in specialization
Marine Biology and Ecology
Autumn: BI3060, BI3063, KJ3051, BI3084, TBT4135, TBT4145 Spring: TBT4125
Marine Biochemistry and Biotechnology
Autumn: BI3060, BI3063, KJ3051, TBT4135, TBT4145, Spring: TBT4125, TEP4265

d) This course is taught intensively
e) This course is taught every second year, 2015, 2017
a) A-list
Courses are considered when planning the teaching and examination schedule
b) B-list
Courses are NOT considered when planning the teaching and examination schedule

Other courses can be chosen
C=Compulsory
O= Optional

MSc in Marine Coastal Development (MACODEV)
1st and 2nd year Specialization 30 credits

Ex	Subject no	Subject title	Note	Cr	Specialization		
					1	2	3
1st sem		**Compulsory courses**					
autumn	TMR4137	SUST UTIL OF MARINE RESOURCES		7,5	C	C	C
	BI3061	BIOL OCEANOGRAPHY		7,5	C	C	C
		Optional courses A-list	a				
	KJ3051	OCEAN SPACE: MARINE BIOGEOCHEMICAL PROC	1,2,3	7,5	O	O	O
	TBT4135	BIOPOLYMERS	3	7,5	O	O	O
	TBT4145	MOLECULAR GENETICS	3	7,5	O	O	O
	TMR4115	DESIGN METHODS	1,2	7,5	O	O	O
	TMR4130	RISK ANALYSES AND SAFETY MANAGEMENT	1,2	7,5	O	O	O
	TMR4135	FISHING VESSEL AND WORK BOAT DESIGN	2	7,5	O	O	O
		Optional courses B-list	b				
	BI3060	EXPERIMENTAL MARINE BIOLOGICAL METHODS	3,d	7,5	O	O	O
	BI3063	BIOLOGICAL AND GENETIC STOCK MANAGEMENT	2,3	7,5	O	O	O
	BT3110	AQUATIC FOOD PROCESSING AND TECHNOLOGY	1,2,3	7,5	O	O	O
	TBT4140	BIOCHEMICAL ENGINEERING		7,5	O	O	O
	KJ3050	MARINE ORGANIC ENVIRONMENTAL CHEMISTRY	3	7,5			O
	KJ3072	ADVANCED AQUATIC CHEMISTRY	3	7,5			O
	TIØ4120	OPERATION RESEARCH, INTRO		7,5		O	
	TMR4215	SEA LOADS	2	7,5	O	O	O
	BT3115	PRIMARY PRODUCTION – AQUACULTURE FISH	1,2,3	7,5	O	O	O
	BT3120	AQFOOD SUPPLY CHAIN	1,2,3	7,5	O	O	O
	BT3125	AQFOODSAFETY	1,2,3	7,5	O	O	O
	TTT4175	MARINE ACOUSTICS		7,5	O	O	O
	TVM4145	UNIT PROC IN WATER AND WASTEWAT TREATM		7,5	O	O	O
	TEP4223	LIFE CYCLE ASSESSMENT		7,5	O	O	O
2nd sem		**Compulsory courses**					
spring		EXPERTS IN TEAMWORK		7,5	C	C	C
		Optional courses A-list	a				
	TBT4125	FOOD CHEMISTRY	2,3	7,5	O	O	
	TEP4265	THERMAL AND PROCESS ENGINEERING FOR BIOMATER.	2	7,5	O	O	
	TMR4120	UNDERWATER ENGINEERING, BC	2	7,5	O	O	
	TMR4140	DESIGN OF MARINE PRODUCTIONS PLANTS	1	7,5	O	O	O
	TMR4230	OCEANOGRAHY	2	7,5	O	O	O
	TMR4225	MARINE OPERATIONS		7,5	O		O
		Optional courses B-list	b				
	BI3066	MARINE JUVENILE PRODUCTION	1,d,	7,5	O	O	O
	BI3073	GENETICS TOXICOLOGY	1,d	7,5	O		O
	SØK2004	INDUSTRIAL ECONOMICS		7,5		O	
	TMR4240	MARINE CONTROL SYSTEMS		7,5		O	

Ex	Subject no	Subject title	Note	Cr	1	2	3
3rd sem		**Compulsory courses**					
autumn		**Specialization courses**					
	TBT4505	BIOTECHNOLOGY, SPEC COURSE	3	7,5	C	C	C
	TMR4575	FISHERIES AND MARINE RESOURCES, SPEC COURSE	2	7,5	C	C	C
		Specialization projects					
	TBT4505	BIOTECHNOLOGY, SPEC PROJ	3	7,5	C	C	C
	TMR4570	FISHERIES AND MARINE RESOURCES, SPEC PROJ	2	7,5	C	C	C
		Optional courses					
	BI3060	EXPERIMENTAL MARINE ECOL METHODS	2	7,5	O	O	O
	BI3063	BIOLOGICAL AND GENETICAL STOCK MANAGEMENT	3	7,5	O	O	O
	BI3071	ADV ECOTOXICOLOGY	1	7,5	O		
	TBA4265	ARCTIC AND MARINE CIVIL ENGINEERING		7,5		O	
	TBT4135	BIOPOLYMERS	2	7,5	O	O	O
	TBT4140	BIOCHEMICAL ENGINEERING	1	7,5	O	O	
	TBT4145	MOLECULAR GENETICS		7,5	O	O	O
	TBT4175	AQUATIC FOOD PROCESSING AND TECHNOLOGY	1,2,3	7,5	O	O	O
	BT3120	AQFOOD SUPPLY CHAIN	1,2,3	7,5	O	O	O
	BT3125	AQFOODSAFETY	1,2,3	7,5	O	O	O
	TMR4115	DESIGN METHODS		7,5	O	O	
	TMR4135	FISHING VESSEL AND WORK BOAT DESIGN	2	7,5	O	O	O
	TMR4190	FINITE ELEMENT METHODS IN STRUCTURAL ANALYSES	2	7,5	O	O	O
	TMR4215	SEA LOADS		7,5	O	O	O
	TTT4175	MARINE ACOUSTICS		7,5	O	O	
	TEP4223	LIFE CYCLE ASSESSMENT		7,5	O	O	
	TVM4145	UNIT PROC IN WATER AND WASTEWAT TREATM		7,5	O	O	
4th sem		**Compulsory courses**					
spring	BT3910	BIOTECHNOLOGY, MASTER THESIS		30	C	C	C
	TMR4930	MARINE TECHNOLOGY, MASTER THESIS		30	C	C	C

1. Aquaculture
2. Marine Harvesting
3. Marine biology and Biotechnology

1) Aquaculture:
The following courses are recommended in specialization:
Marine Aquaculture Systems
Autumn: BI3064, TMR4115, TMR4130 Spring:BI3065, TMR4140, TTK4170
Recycling Aquaculture and Environmental Analysis
Autumn: BI3064, BI3071, TBT4130, TMR4115, TMR4130 Spring :BI3065, BI3073, TBT4140, TMR4140, TTK4170

2) Marine Harvesting
The following courses are recommended in specialization:
Processing of Marine Resources
Autumn: BI3060, BI3063, TEP4265, TMR4115, TMR4135, Spring: TBT4125, TBT4135, TMR4215
Sustainable Marine Harvesting
Autumn: TEP4265, TMR4115, TMR4130, TMR4135 Spring: TBT4125, TMR4190, TMR4215, TMR4120, TMR4230

3) Marine Biology and Biotechnology:
The following courses are recommended in specialization:
Marine Biochemistry and Biotechnology
Autumn: BI3060, BI3063, TBT4135, TBT4145 Spring: TBT4125, TTT4195

d) This course is taught intensively
a) **A-list** Courses are considered when planning the teaching and examination schedule
b) **B-list** Courses are NOT considered when planning the teaching and examination schedule

Other courses can be chosen
C=Compulsory
O= Optional

MSc in Aquatic Food Production - Safety and Quality

Programme code: MSAQFOOD

AQFood is an international master education open to all and offering mobility between the Nordic Countries. The programme is offered by a consortium of five leading universities in the Nordic countries. The universities are working together to deliver a key education for the aquatic food sector. The five universities are:

- Norwegian University of Science and Technology (NTNU), Department of Biotechnology, Trondheim, Norway.
- Technical University of Denmark (DTU), National Food Institute, Kgs Lyngby, Denmark.
- Norwegian University of Life Science (UMB), Department of Mathematical Sciences and Technology, Ås, Norway.
- Swedish University of Agricultural Sciences (SLU), Department of Wildlife, Fish and Environmental Studies, Umeå, Sweden.
- University of Iceland (HI), School of Engineering & Natural Science, Reykjavik, Iceland.

with three specialised study lines:

Aquatic Production, Natural Resources and Industrial Production.

Learning Objectives

The focus in this programme is to address the entire value chain and to consider important aspects of economy, production management as well as environmental challenges making it a unique education on master level. Students will obtain the necessary background and knowledge of the operation of the entire aquatic food production chain as well as safety and quality issues. The understanding of the role of the various academic fields that contribute to the efficiency and transparency of the aquatic food supply chain will be enhanced and field studies will ensure the necessary industrial focus. The AQFood master's programme has three study tracks: Aquatic Production, Natural Resources, and Industrial Production. The master's programme includes a 30 ECTS core (4 courses taken during the 1st semester). The core courses are given as web based learning.

Knowledge

The MSc graduate in AQFood has:

- Substantial knowledge of the entire aquatic value chain – including global trends in terms of resources and environmental impact, basic concepts of food quality and food safety, production systems (aquaculture and fisheries), methods for processing and packaging of aquatic food products and systems for transport/logistics of aquatic products and the role of supply chain management and information technologies to enhance transparency and ensure quality, safety and traceability of products, challenges in innovation and marketing for the aquatic fish/food sector.
- In- depth knowledge in a specific area based upon research experience from a master's project
- In-depth knowledge within the chosen field of specialization

Proficiency/skills

The MSc graduate in AQFood:

- Is able to carry out a scientific work process from theoretical background to hypothesis generation, data collection and interpretation of results
- Is able to use his or her knowledge to solve challenges in the aquatic food value chain
- Is able to evaluate methods and results within the field of specialization critically

General competence

The MSc graduate in AQFood:

- Is able to communicate research results in English, both written and orally, to professionals and to a wider audience
- Is able to acquire and evaluate research information
- Is able to work on a project alone and in cooperation with others in interdisciplinary groups
- Is able to contribute to innovative thinking within the specialization in particular
- Has got competence within health, environment and safety (HSE) in general ,and within HSE within the specialization in particular
- Is familiar with research ethics

Information about the Master's Study

Admission requirements

Admission to the MSc programme in Aquatic Food Production - Safety and Quality requires a BSc or BSc Eng degree corresponding to a minimum 180 ECTS credits in: Chemistry, Biology, Biotechnology, Food science, Food technology, Industrial Engineering, Life science, Environment or other comparable degree.

When you apply you have to decide which study track you want to follow, therefore you have to ensure that you fulfill the requirements for both universities in your study track. Applicants for NTNU must have basic knowledge in statistics, mathematics and biochemistry.

When applying for admission, you must provide evidence of your academic achievements and proficiency in English. TOEFL or IELTS certificates must be original and sent directly to DTU from the test centre.

TOEFL: Paper-based: 580 (written section grade 4,5). Computer-based test: 237 (assay writing grade 4,5). Internet-based test: 92 (written section grade 22).

IELTS: 6.5, no section lower than 5.5 (only IELTS Academic Training accepted).

English language test exceptions:

- Applicants who have completed a university degree instructed in English at a university that is physically located in one of the following countries: USA, Canada, UK, Ireland, Australia, New Zealand.
- Applicants who have completed at least a 3-year degree instructed in English in an EU/EEA country.

- Applicants with upper secondary education and a Bachelor's degree (issued or ongoing if the applicant is currently enrolled in the last semester) from a Nordic country may be exempted from an additional English test. Please include the school leaving certificate of your upper secondary education into your application package.

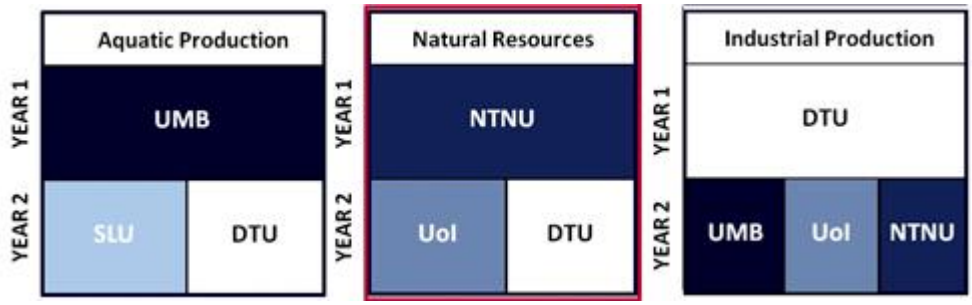
Workload and structure

The Nordic Master Programme in "Aquatic Food production – Safety and Quality" AQFood is a 120 ECTS double degree obtained in two years. It is a requirement that you start at one University and finish at another University depending on your choice for the specialization. The programme requires two years of full-time study, beginning with the autumn term (medio August). The normal work load for a full-time student for one academic year is 60 ECTS credits.

The first two semesters are taking place either at UMB, NTNU, or DTU with three possible study tracks:

- Aquatic Production (UMB)
- Natural Resources (NTNU)
- Industrial Production (DTU)

The last two semesters take place at one of the 5 universities depending on the study track you have chosen.



Compulsory courses for all students in the first year:

Semester 1:

- 23UM Primary Production – Aquacultures and Fisheries(BT3115) (7,5 ECTS)
- 23NT Aquatic Food Processing and Technology (BT3110) (7,5 ECTS)
- 23DT Safety and Human Health Effects of Aquatic Food (BT3125) (7,5 ECTS)
- 23HI Aquatic Food Supply Chain Management, Environment and Resources (BT3120) (7,5 ECTS)

Study track: Aquatic Production

If you choose this study track, you are admitted at UMB, and then take your last year either at SLU or at DTU. In the first year your will gain competences in Aquatic Production at UMB and in the second year you can decide to carry on your studies either at DTU or at SLU. At DTU you will gain additional competences in industrial production whilst at SLU you will gain additional competences in Fish and Wild Life Management.

The MSc graduate in AQFood, study track aquatic production:

- Is able to analyse and evaluate systems used in aquatic production and optimize the production of broodstock, juvenile and adult fish
- Is able to evaluate the cause and effect of different production techniques strategies and handling process during the life of the fish and final process of fish as food (DTU specialization)
- Is able to assess quality attributes by relevant sensory, microbiological, biochemical and chemical methods throughout the production (DTU specialization)
- Is able to classify on the basis of problem formulation, method accomplishment, personnel and equipment requirements, permits and animal welfare and ethical issues (SLU specialization)
- Is able to apply population ecology, especially with regard to sustainable use of harvested animal populations and the conservation of small populations (SLU specialization)

Compulsory courses in the first year:

Semester 2:

- TAT254 Basic Aquaculture Engineering (5 ECTS)
- TAT211 Aquaculture Production (10 ECTS)
- TAT250 Aquaculture Laboratory Course (5 ECTS)

Compulsory courses in the second year:

Semester 3:

Specialization: UMB/SLU: Aquatic Production and Fish Wild Life Management

- BI1123* Fish and Wildlife Census Techniques (15 ECTS)
- BI1076* Project based advanced course (15 ECTS)

**Not mandatory but recommended*

or

Specialization: UMB/DTU Aquatic Production and Industrial Production

- 23501 Biological Quality - Pre-harvest Impact on Post-harvest Product Quality (5 ECTS)
- 23DT Aquatic Food Microbiology – (5 ECTS)
- 23DT Food Quality - Preserving high quality throughout the production (5 ECTS)

Semester 4:

Master thesis

Study track: Natural Resources

In the first year your will gain competences in Natural Resources at NTNU and in the second year you can decide to carry on your studies either at DTU or at HI (UoI). At DTU you will gain additional competences in Industrial Production whilst at HI (UoI) you will gain additional competences in Supply Chain Management.

The MSc in AQFood, study track natural resources:

- Is able to evaluate the economical, technical, environmental and biological challenges of the aquatic food value chain from a management and sustainability perspective
- Is able to estimate the impact of laws and regulations that can have effect on revenue or evaluate the cause and effect of different production techniques strategies and handling process during the life of the fish and final process quality of fish as food

Compulsory courses in the first year:

Semester 2:

- TMR4137 Sustainable Utilization of Marine Resources (7.5 ECTS)
- BI3061 Biological Oceanography (7.5 ECTS)

Compulsory courses in the second year:

Semester 3:

Specialization: NTNU/(HI (UoI): Natural Resources and Supply Chain Management

- IÐN110F Production Planning (7.5 ECTS)
- IÐN116F Supply Chain Management (7.5 ECTS)

or

Specialization: NTNU/DTU: Natural Resources and Industrial Production

- 23501 Biological Quality - Pre-harvest Impact on Post-harvest Product Quality (5 ECTS)
- 23DT Aquatic Food Microbiology – (5 ECTS)
- 23DT Food Quality - Preserving high quality throughout the production (5 ECTS)

Semester 4:

Master Thesis

Study track: Industrial Production

In the first year your will gain competences in Industrial Production at DTU and in the second year you can decide to carry on your studies either at NTNU, UMB or HI (UoI). At NTNU you will gain additional competences in Food Biochemistry, at UMB in Product Development whilst at HI (UoI) you will gain additional competences in Supply Chain Management.

The MSc in AQFood, study track Industrial Production:

- Is able to evaluate environmental effects of specific aquatic food processing operations and have knowledge of aquatic food quality and shelf-life together with the ability to evaluate quality attributes by relevant sensory, microbiological, biochemical and chemical methods.

- Is able to document aquatic food processing, quality, safety and health effects taking into account national and EU-regulations
- Is able to estimate hos ICT can influence supply chain management in aquatic food chains for optimizations of processes and evaluate how supply chain management can improve the quality of safety related recalls (UoI specialization)

Compulsory courses in the first year:

Semester 2:

- 23102 Food Safety in Production Chains (10 ECTS)
- 23520 Food Process Design (10 ECTS)

Mandatory courses for the second year:

Semester 3:

Specialization: DTU/UMB: Industrial Production and Product development

- MVI 385 Food Product Development (10 ECTS)
- INN410 Intellectual Property Rights and Innovation (5 ECTS)

or

Specialization: DTU/(HI (UoI): Industrial Production and Supply Chain Management

- IÐN110F Production Planning (7.5 ECTS)
- IÐN116F Supply Chain Management (7.5 ECTS)

or

Specialization : DTU/NTNU: Industrial Production and Food Biochemistry

- BT 8119 Food Chemistry Advanced (7.5 ECTS)
- BT 8112 Salting of Fish (7.5 ECTS)

Semester 4:

Master Thesis

The Master thesis

The Master thesis should be developed as your own original work (with some support from your adviser). Any quotation, use of data, information etc from other sources (including the scientifically literature and your fellow students) should therefore be carefully listed and included in the reference list of your thesis, according to best practice within your field of study.

Programme Specific Regulations

The students should follow the rules and regulations at the university at which they reside at any given moment.

Master's agreement

Students who are admitted at NTNU have to make a Master's agreement. This agreement comprises your syllabus and master project together with regulations for the counseling given during the master's study. The subjects, compulsory or elective, stated as syllabus in your Master's agreement cannot be changed. If there for serious reasons develops a need for change, the Master's agreement must be revised. The supervisor, the responsible Department and the student must agree upon the revision and the new agreement filed.

Important deadlines at NTNU

- 15th of February (2nd year): Deadline for registration for the final Master's Degree exam (through STUDWEB)
- 15th of May (2nd year): Deadline for the submitting the master thesis. If the thesis is not submitted within this date the grade "not passed" will be awarded, unless there is handed in an application for extension of the deadline in reasonable time before the deadline. The reasons given in the application must be in accordance with Supplementary Regulations for the Natural Sciences (UTF) § 20.3 and the Examination Regulations at NTNU, § 20. Alternatively such an application may be dealt with, taken into consideration The Supplementary Regulations for the Natural Sciences (UTF) § 7 and the Examination Regulations at NTNU, § 7 . See below for further information regarding §7 and §23.3.
- 15th of June (approximately, 2nd year): is the date for the final Master's Degree exam. (Individual agreement with the respective Department, approximately four weeks after the thesis is submitted).

Leave of absence from the Master Study (UTF § 7) (extract):

a) Leave of absence from the master studies of two years of duration and from the two last year of master studies of five years of duration is normally not granted.

b) Leaves of absence may nevertheless be granted when applied for and compelling circumstances are present. Such circumstances might be illness (yourself or among close family member) etc.

Prolongation of the study (UTF § 20.3) (extract):

The master thesis is time limited. In case of illness, the deadline for handing in the thesis can be postponed equivalent to the time of absence due to illness. The illness must be documented by medical certificate.

If there is a valid reason for not handing in the thesis in time, one can apply for up to three months prolongation of the deadline. If the thesis is not handed in within the extended deadline, a new extension must be applied for, or else the candidate is regarded failed. Delay of deadline can only be applied for twice.

Valid reasons for postponement (in addition to illness) is teaching, organized student activity, social work and unmerited problems concerning the thesis. Written documentation or statement is required, in addition to a new plan of completion. The Faculty, or Department when given the assignment by the Faculty, determines the application. When the reason for delay is teaching, organized student activity or social work, the extended time given is according to the time spent on these activities.

The agreed delay has no influence on the evaluation of the thesis.

MASTER OF SCIENCE IN NATURAL RESOURCES MANAGEMENT

The Master of Science in Natural Resources Management programme is a two-year international
interdisciplinary programme, consisting of the three specializations Biology, Resource Geology and Geography. It is especially designed to give the students an understanding of the importance of management for sustainable use of natural resources, an understanding of the connections and the ability to communicate between different disciplines and actors.

Natural resources provide mankind with important ecosystem services such as clean water, energy, minerals and biological resources in terrestrial, aquatic and marine ecosystems which are essential for survival and development of mankind. However, the increasing demands for these natural resources due to the growth of the human population combined with the decrease of the finite resources urgently calls for a sustainable management of these resources. Such management requires an interdisciplinary approach including in-depth knowledge about specific resources as well as a holistic perspective, including ecological, economic and social aspects. It also requires a strong ability to communicate in order to establish dialogues between the different disciplines involved as well as between the stakeholders, and a good understanding of the connections between these different actors.

MSc programme in Natural Resources Management aims at giving a unique education and required knowledge that will contribute to find sustainable solutions of interdisciplinary challenges related to the management of natural resources.

The Master of Science in Natural Resources Management is an interdisciplinary cooperative programme involving three faculties at NTNU, and the programme is administrated by the Faculty of Natural Sciences and Technology.

The programme offers 3 specializations:

- Biology
- Resource Geology
- Geography

Learning outcomes
The interdisciplinary master programme in Natural Resources Management provides students with advanced knowledge, analytical skills and general competence at an advanced level aiming for work within the fields of research, public administration, governmental and non-governmental organizations, education and industry.

The Masters in Natural Resources Management offers specializations in the 3 disciplines: Biology, Resource Geology and Geography. The master's programme includes 30 ECTS elective courses that allow students to be interdisciplinary and flexible in the individual composition of their academic profile.

The program will provide a thorough insight into processes and mechanisms related to conflicting interests over the use of natural resources. In the master's thesis the student will obtain an advanced in-depth understanding in a topic that is relevant within the field of management of natural resources.

Knowledge
The MSc graduate in Natural Resources Management has:

- Substantial multidisciplinary knowledge about natural resources management related to the research within the specialization
- Substantial knowledge in a specific area based upon research experience from a masters project
- Substantial knowledge about various methodological and analytic approaches that are used within the specialization.

Proficiency/Skills
The MSc graduate in Natural Resources Management:

- Can independently carry out a complete scientific work process, including the theoretical background, hypotheses generation, collecting and analyzing data as along with the interpretation of results and their presentation
- Has high competence and multidisciplinary project experience within selected topics related to natural resources management and ability to contribute in a multidisciplinary team towards the management and sustainable use of natural resources
- Can critically evaluate methods and results within the field of specialization.

General Competence
The MSc graduate in Natural Resources Management:

- Can communicate research results in English, both in written and oral to both professionals and to a wider audience
- Can acquire and evaluate research information
- Can work on a project independently and in cooperation with others in interdisciplinary groups
- Can contribute to innovative thinking within the specialization in particular
- Has competence within Health- Environment and Safety in general, and within Health- Environment and Safety within the specialization in particular
- Is familiar with research ethics.

Specialization: Biology
With a specialization within biology the student holds an in-depth competence within the fields of conservation biology, ecology, evolution, systematics and/or physiology. The student with specialization within biology will through the work on the master project obtain an in-depth knowledge *in a biologically based research topic* which is related to the management of the biological resource in question.
The MSc graduate in Natural Resources Management with biology specialization will hold the following knowledge and skills:

Knowledge
The MSc graduate in Natural Resources Management has:

- A broad knowledge within the respective biological field (theoretical and experimental) and how this integrates with management of natural resources for sustainable use
- Knowledge about biological diversity, ecosystem services and other aspects of conservation biology and how this knowledge can be applied to find environmentally sound solutions
- A thorough understanding of evolutionary and ecological processes.

Proficiency/Skills
The MSc graduate in Natural Resources Management:

- Can apply the biological knowledge as well as the knowledge about management of

natural resources within research, public administration, governmental and nongovernmental organizations
- Can evaluate and apply relevant theory, methods and analytic approaches within the respective field of biology, including statistical methods
- Can implement knowledge from several research fields and disciplines.

Specialisation: Geography

A specialization within geography provides the student with in-depth competence within selected geographical concepts and theories, and skills for applying this competence to natural resource management issues. The students also attain an in-depth competence in relevant geographical research methods and understand their relevance for research on natural resource management issue. The student specializing in geography will through the master project acquire in-depth knowledge within a research topic directly or indirectly related to the natural resource management issue in question.

The MSc graduate in Natural Resources Management specializing in geography will hold the following knowledge and skills:

Knowledge

The MSc graduate in Natural Resources Management has:
- Acquired a deep understanding of general concepts and theories from the field of geography, and integrated this with an understanding of concepts and theories from the specific field of natural resource management
- Knowledge about research fields in geography such as environmental geography, political ecology, natural resource management or other relevant specialisations in geography, and understand how this knowledge can be applied on environmental issues.

Proficiency/Skills

The MSc graduate in Natural Resources Management:
- Can evaluate and apply relevant theory, methods and analytic approaches within the field of geography on natural recourse management issues
- Can implement knowledge from several research fields and disciplines
- Can apply geographical knowledge as well as knowledge about management of natural resources in public administration, governmental and non-governmental organisations.

Specialisation: Resource Geology

Knowledge

The MSc graduate in Natural Resources Management has:
- A solid theoretical knowledge of mineral and ore-deposit forming processes
- Specialized knowledge on a specific type of geological deposits.
- Specialized knowledge of several analytical methods relevant to in depth studies of geological deposits
- General knowledge of mining techniques and environmental as well as socio-cultural implications of economic exploitation of geological deposits

Proficiency/skills

The MSc graduate in Natural Resources Management
- Are able to partake in studies of geological deposits in collaboration with relevant experts
- Know where to find and how to retrieve and interpret relevant geological background

information
- Know how to design and initiate sampling of geological data relevant for a given deposit type

Admission Requirements

General requirements

Norwegian/Nordic and international applicants should hold a BSc degree or equivalent university education either in Biology, Resource Geology or Geography. Applicants holding another related Bachelor degree may also be considered. There will be an individual evaluation of applicants. The Bachelor degree must be in accordance with the admission requirements to one of the three specializations in this Master's programme. To illustrate; a background with a Bachelor degree in Biology does not qualify for admission to MSc Natural Resources Management with specialization in Resource Geology, but may only qualify for the specialization in Biology. Thus, the Bachelor background of the applicant must be consistent with the specialization in the MSc Natural Resources Management programme that you apply for.

Specialization Biology:

Applicants who apply for specialization in Biology need to have a Bachelor degree including basic courses in biology, minimum 80 ECTS. As example of requirements, check the plan of study in BSc degree in Biology at NTNU (http://www.ntnu.edu/studies/bbi). The bachelor degree must include courses in resources management, planning and/or interdisciplinary project management equivalent of minimum one quarter of a year full time study. Priority will be given to applicants with background in introductory university level in Mathematics and Statistics.

Specialization Resource Geology:

Applicants who apply for a specialization in Resource Geology must hold a Bachelor degree in Bedrock-and Resource Geology or equivalent. As an example of requirements, check the plan of study for BSc degree in Bedrock- and Resource Geology at NTNU (http://www.ntnu.edu/studies/bgeol/bedrock). Introductory university level of Mathematics and Statistics are required. The bachelor degree must include courses in resources management, planning and/or interdisciplinary project management equivalent of minimum one quarter of a year full time study.

Specialization Geography:
Applicants who would like to apply for specialization in Geography should hold a Bachelor degree including at least 80 ECTS of studies within geography and/or natural resources management. Other relevant qualification can be accepted upon approval by the Department of Geography.

The bachelor degree must include courses in resources management, planning and/or interdisciplinary project management equivalent of minimum one quarter of a year full time study. Applicants with a Bachelor of Social Sciences in Geography from NTNU are qualified

for admission.

English language requirements

Applicants who are not exempted from the English language requirement, must document that they have passed a recognized test in English; TOEFL or IELTS.
http://www.ntnu.edu/studies/langcourses TOEFL (Test of English as a Foreign Language) with a minimum score of 600/90 points on the paper based/internet based test IELTS (International English Language Testing Service) with a minimum score of band 6.5.

Programme Structure and specializations

About the study programme: The MSc programme in Natural Resources Management is a 2 years of full-time study (120 ECTS credits) integrating Norwegian/Nordic and international students. The normal workload for a full-time student during one academic year is 60 ECTS credits. The study is structured around 4 compulsory core courses, elective courses and a Master's thesis (60 ECTS credits).

The Master's thesis is to be planned and started already in the first semester and has to be completed in semester 4. The thesis work will as far as possible be integrated in ongoing research projects at their respective department according to the field of study. The content of the thesis should fulfill an academic level appropriate to master level course. An individual supervisor will be assigned in semester 1, who will be responsible for supervising the Master's thesis.
One of the compulsory core course is RFEL3080 Scientific Seminars, which is running through all the 4 semesters. There are also a number of elective courses, which give options to fit background and interests for the student throughout the studies.

Field work: After the first year of studies, during the period of mid-June to mid-August, the candidates may be given the opportunity to go back to their home countries to do field work if this is necessary for the completion of their thesis. Students who are supported by the Quota Programme are awarded an extra grant to cover field-trip expenses. Students outside the Quota Programme must cover the travel and field costs themselves. Project allowances are offered in some special cases.

Structure of the International Masterstudy in Natural Resources Management

Year	Semester						Total credits
2	4. semester Spring	**Special Syllabus for Master Degree* (7,5 credits)**				**RFEL 3080 Scientific Seminars in Natural Resources Management (7,5 credits)**	30
	3. semester Autumn	Master Thesis (60 credits)					30
1	2. semester Spring	**Elective course (7.5 credits)**	**Elective course (7.5 credits)**	**Elective course (7.5 credits)**			30
	1. semester Autumn	**Elective course (7.5 credits)**	**RFEL 3081 Natural Resources Management, Interdisciplinary Project (7.5 credits)**	**GEOG 3030 Natural Resources Management (7.5 credits)**			30
							120

Mandatory courses (30 credits)
Elective courses (30 credits)
Master thesis (60 credits)

* Course code for Special Syllabus for Master's Degree for each of the specializations in the programme:
Biology: BI3091
Resource Geology: GEOL3093
Geography: GEOG3091

The Special syllabus examination (and similar special curriculum courses) can be held either together with the final Master's examination or at an earlier stage in the master programme. This encompass all the specializations at the programme, (BI3091, GEOL3093, GEOG3091)

** Course code for Master's Thesis for each of the specializations in the programme:
Biology: NATRBI3900
Resource Geology: GEOL3090
Geography: GEOG3940

Elective Course list 2014-2015
BI2001 Biogeography and Biosystematics (7,5 credits) Spring
BI2041 Human Evolution and Behaviour (7,5 credits) Autumn
BI2017 Genetics and Evolution I (7,5 credits) Autumn
BI2033 Population Ecology (7,5credits) Spring*
BI2034 Community Ecology (7,5credits) Autumn *
BI2043 Biodiversity and Conservation Biology I (7,5 credits)Autumn*
BI2044 Ethology (7,5 credits) Spring
BI2045 Communication and Reproduction Behaviour (7,5 credits) Spring
BI3010 Population Genetics (7,5 credits) Autumn
BI3036 Plant Ecology (7,5 credits) Autumn

BI3037 Freshwater Ecology (7,5 credits), Autumn
BI3051Evolutionary Analyses (7,5 credits) Autumn
BI3072 Environmental Toxicology (7,5 credits) Autumn
BI3082 Biodiversity and Conservation Biology II (7,5 credits) Autumn
BI3083 Evolutionary and Ecological Genetics (7,5 credits) Spring
BI3084 Conservation Biology (7,5 credits) Autumn
BI3040 Behavioural Ecology (7,5 credits) Spring
***BI2017, BI2033, BI2034 and BI2043 are mandatory in BSc Biology, NTNU and these students cannot choose these elective courses.**
TGB4115 Mineral Deposit Geology (7,5 credits) Autumn
TGB4120 Prospecting and Formation of Selected Ore-Deposits (7,5 credits) Spring
TGB4135 Basin Analysis (7,5 credits) Spring
TGB4170 Diagenesis/Reservoir Quality (7,5 credits) Spring
TPG4177 Carbonate Reservoir Characterization (7,5 credits) Autumn
GEOG 2007 Effects of Climate Change (7,5 credits) Atumn
GEOG 2009 Vector Based GIS (7,5 credits) Spring
GEOG3003 Methodology and the Research Process(7,5 credits) Autumn
GEOG3005 Qualitative Methods (7,5 credits) Autumn and Spring
GEOG3006 Quantitative Methods (7,5 credits) Spring
GEOG3505 Landscape and Planning (15 credits) Autumn
GEOG3515 Environment, Development and Changing Rural Livelihoods (7,5 credits) Autumn
GEOG3523 GIS Data Capture and Mapping, (7,5 credits), Spring
SØK3524 Environmental and Resource Economics (15 credits) Autumn and Spring
POL2022 Petroleum Management, Political Economy and Ethics (7,5 credits) Autumn
FI5207 Multicultural Conflicts and Ethics (7,5 credits) Spring
FI5205 Corporate Responsibility and Ethics (7,5 credits) Autumn
HIST3295 International Economic Contemporary History (7,5 credits) Autumn

The list of the following courses can be elected by all students attending the international master programme MSc Natural Resources Management if you have the knowledge demanded in the course description. It is also possible to choose other courses apart from this list according to specific interest and in agreement with the supervisor and responsible Department.

Examples of Master's thesis in Natural Resources Management

Specialization Biology:
2009:
Borecha Degitu Endale: Human-elephant conflict: a study in Babile Elephant sanctuary, Ethiopia
Pokharel Bimal: Livelihood impact of hydropower development and river diversions in the downstream of river Basin: a retrospective case study of Khimti river, Eastern Nepal
Vikanes Berit Haga: Does the personal background of the caseworkers influence natural resource management decisions?
Welesamiel Mengstab Tilahun: Optimization of on-site treatment systems: filtration using geo-textile filters for source separated black wastewater
2011:
Bentsen Vidar Johan: Desnity dependent habitat use of Atlantic salmon, *Salmo salar* L.- stranding in hydropower rivers
Dhuli Priyanka: Metabolite changes in conifer buds and needles during bud break - Norway spruce (*Picea abies*) and European silver fir (*Abies alba*)
Kvistad Arne Ivar: Why Do Some Areas Have Higher Density of Forest Grouse Than

Others?
Lyamuya Richard Daniel: Human-carnivore conflict over livestock in the eastern Serengeti ecosystem with special emphasis on African wild dogs (*Lycaon pictus*)
Marealle Wilfred Njama: Factors affecting group size and vigilance behaviour of Maasai giraffe (Giraffa camelopardalis tippelskirchi) in the Serengeti-Ngorongoro ecosystem, Tanzania
Peter Mramba Rosemary: Nutritional Status of Children as an Indicator of Bushmeat Utilization in Western Serengeti
Sandberg Erin Christina: Do moose adjust their behavior following wolf recolonization?: the case of bedsite habitat selection
2012:
Bunikyte Raimonda: An assessment of gains in conservation: A case study in Sør-Trøndelag, Norway
Fliflet Henrik Rasmussen: Spatial and Temporal Variation in Moose- (*Alces alces*) Road Crossings
Hansen Suzanne: Red-listed vascular Plant Species in Sub-Alpine and Alpine Landscapes: How does Land-use affect their Distribution?
Lamsal Saraswati: The park-people conflict in the Chitwan National Park with reference to the Asiatic one-horned rhinoceros (*Rhinoceros unicornis*)
Morales Julio: Patterns of Distribution of Paspalum species along environmental gradients landscapes in the Nicaraguan Dry Tropical Forest
Paul Ajit Kumar: Environmental degradation and loss of traditional agriculture as two causes of conflicts in shrimp farming in southwest coastal Bangladesh: present status and probable solution
Roalsø Erik Roall: Alien plant species in Svalbard
2013:
Hariohay Kwaslema Malle: Impacts of human settlements and land use changes in Kwakuchinja wildlife corridor, Northern Tanzania
Hossen Amir: Human-elephant conflict in Bangladesh; causes and intensity of fatalities.
Huseby Oddmund: Spatio-temporal variation in moose-vehicle collisions: the effect of varying traffic intensity and light conditions
Manyama Flora: Factors affecting the attitudes of the local inhabitants of the Kondoa District-Tanzania, toward the red-billed quelea (*Quelea quelea*)
Ofstad Endre: Seasonal Variation in Site Fidelity of Moose (*Alces alces*)

Specialization Resource Geology:

2012:
John Biteme Kangeze: Ore forming potential of the Atchiza Suite and Sustainable management of mineral deposits in Mozambique

Specialization Geography:

2009:
Pathamanandakumar Vyddiyartnam: The impacts of Ecotourism in Maussawa Estate, Sri Lanka.
2011:
Egbert Jacob Holtrop: User conflicts and management of Urban Woodlands-The case of Trondheim, Norway and Arnhem, The Netherlands.
2012:
Phung Thi Nguyen: Causes of forest conflicts- Case study of three districts in Lam Dong province, Vietnam
David Mugambi Mbuba: Impact of Particitpatory Foreste Management on Livelihoods; A Case of Arabuko Sokoke Foreste along the Kenyan Coast.
Elvise Ngome Kome: Assessing the Participation of Stakeholders in Natural Resource

Management- A Case of the Fako Mountain Forest, Cameroon.
Muhammed Niyas Fathirma Muneera: Public- Private Partnership (PPP) in Solid Waste Management- Literature Review of experiences from Developing Countries with special attention to Sri Lanka.
2013:
Nana Yaa Owusu-Banahene: Oil versus Fish: A Study of the Conflict between Different Resources Users in the Marine Commons of Cape Three Points- Ghana.
Benno Rummel: Investigation of Landsat satellite image change detection of snow and ice cover- A seasonal and multi annual time scale approach to evaluate this technique as a tool for water resource management.
Jerome Jeffison Yaw Ofori: The role of Information Accessibility in achieving Transparancy and Accoutability in Ghana's oil Industry- A reality check from Cape Three Point.
Sasikumar Kumarasamy: Environmental and Economic Impact of Mangrove Deforestation- Case study of Vadamaradchy East, Sri Lanka.
Anne Guri Aaase: A New Approach Towards Comparing Environmental Impacts From Small-Scale Hydropower, Large-Scale Hydropower and Wind Power.
Ashok Baniya: Response to Impact of Climate Change through Community Manged Forests in Nepal: Is REDD + Panacea for community?
Øistein Løvstad: Transboundary Water Managament- The Case of the Kikagati/Murongo Hydropower Development Project.

Special information about the Master's Study

Workload and Structure
The programme requires two years of full-time study, beginning with the autumn term (medio August). The normal work load for a full-time student for one academic year is 60 ECTS credits.

The Master's study consists of two parts:

1. A written thesis of the project (Master's thesis). The extent of the assignment should correspond to a work load of 60 credits. The work on the thesis is time limited. The thesis have to be submitted within May 15th of the 2nd year, while the students at the specialisation Geography have to submit the thesis May 10th of the 2nd year.
2. An approved selection of courses, of a minimum of total of 60 credits, from what (at least) 30 credits must be courses at 3000-level (master level) (UTF§14.1).

Master's agreement
Every master student has to sign a Master's Agreement. This agreement comprises your syllabus and master project together with regulations for the counselling given during the Master's study. The courses, compulsory or elective, stated as syllabus in your Master's Agreement cannot be changed. If there for serious reason develops a need for change, the Master's Agreement must be revised. The supervisor, the responsible institute and the student must agree upon the revision and the new Agreement filed.

The Master's thesis
The Master's thesis should be developed as your own original work (with some support from your adviser). Any quotation, use of data, information etc from other sources (including the scientifically litterature and your fellow students) should therefore be carefully listed and included in the reference list of your thesis, according to the best practice within your field of study. *There is no tolerance for plagiarism which will result in not achieving the degree.*

Submission and Examination
The student has to:

- Register for the final Master's Degree examination (through STUDWEB) within February the 15th of the 2nd academic year
- Apply for approval of your individual special syllabus if your Master's Agreement demands a special syllabus. It is important that this is done well in advance of the examination. A study committee will evaluate the syllabus, and if it is not accepted, you must change it. Your supervisor must approve and sign the form. The syllabus should be a minimum of 50 pages per credit.
- Submitting the thesis (within the deadline given, (see below) for printing through DAIM *except for the geography students*, who need to contact the Department of Geography or check this link **http://www.ntnu.edu/geography/master-thesis** The Department will give you 5 copies of the thesis. In addition to the evaluation of the thesis, the candidate will have an oral examination consisting of:
- A conversation on/presentation ("defence") of the research assignment (the Master's thesis)
- Examination on the theoretic syllabus of the advanced courses which has previously not been evaluated during the study (at least 7,5 credits, preferentially individual special syllabus). All examinations, except the Individual Special Syllabus (if any) have to be passed before the date of the final Master's Degree examination, unless otherwise stated in your Master's Agreement.
- A grade is given for every course / special syllabus that constitutes a part of the final Master's Degree examination.

Important deadlines

- **15th of October (1st year)**: Decide on a Master's project in cooperation with the supervisor. Geography students have to check with the Geography Department for their process.
- **1st of November** (1st year) Biology students have to register their Master's Agreement in DAIM and hand in the project description. Geography students have to follow the routine at the Department of Geography to hand in the project description and the Master's Agreement, which is not DAIM for the Geography students.
- **15th of February (2nd year):**Deadline for the signing up for the final Master's Degree exam (through STUDWEB)
- **10th of May (2nd year)**. Deadline for the submission of the Master' thesis for the geography students
-
- **15th of May (2nd year)**. Deadline for the submission of the Master' thesis for biology and chemistry students
- Resource geology students have to contact the Department of Geology and Mineral Resources Engineering for individual agreement for delivering.
- If the thesis is not submitted within this date the grade "not passed" will be awarded, unless there is handed in an application for extension of the deadline in reasonable time before the deadline. The reasons given in the application must be in accordance with Supplementary Regulations for the Natural Sciences (UTF) § 20.3 and the Examination Regulations at NTNU, § 20. Alternatively such an application may be dealt with, taken into consideration The Supplementary Regulations for the Natural Sciences (UTF) § 7 and the Examination Regulations at NTNU, § 7 . See below for further information regarding §7 and §23.3.
  15th of June (approximately**, 2nd year)**: is the date for the final Master's Degree exam. There will be individual agreement with the respective Department, approximately four weeks after the thesis is submitted.

Leave of absence from the Master's Study (UTF § 7) (extract):

a) Leave of absence from the master studies of two years of duration and from the two last year of master studies of five years of duration is normally not granted.
b) Leaves of absence may nevertheless be granted when applied for and compelling circumstances are present. Such circumstances might be illness (yourself or among close family member) etc.

Prolongation of the study (UTF § 20.3) (extract):
Time for the Master's study is limited. In case of illness, the deadline for submitting the thesis can be postponed equivalent to the time of absence due to illness. The illness must be documented by medical certificate.

If there is a valid reason for not submitting the thesis in time, one can apply for up to three months prolongation of the deadline. If the thesis is not submitted within the extended deadline, a new extension must be applied for, or else the candidate is regarded failed. The delay of deadline can only be applied for twice.

Valid reasons for postponement (in addition to illness) is teaching, organized student activity, social work and unmerited problems concerning the thesis. Written documentation or statement is required, in addition to a new plan of completion. The Faculty of Natural Sciences and Technology (NT-Faculty), or the Department when given the assignment by the NT-Faculty, determines the application. When the reason for delay is teaching, organized student activity or social work, the extended time given is according to the time spent on these activities.

The agreed delay has no influence on the evaluation of the thesis.

Environmental Toxicology and Chemistry

Programme code: MSENVITOX

Anthropogenic pollution is one of the most significant threats to the environment. Organic and inorganic environmental toxicants originating from human activities are distributed throughout the world via e.g. oceanic currents and atmospheric transport processes. This issue is of global importance. Consequently there is a high demand from both society and industry for scientists with competence within the interdisciplinary scientific area of environmental toxicology and chemistry.

Learning outcomes
The master programme in Environmental Toxicology and Chemistry provides students with knowledge, analytical skills and general knowledge at an advanced level, with the aim of working in research, manufacturing, consulting, education and public administration, or for the purpose of further education in a doctoral program.

The master programme aims to enable students to combine biological and chemical knowledge to solve problems related to environmental pollution.

The master programme is interdisciplinary and will provide students with specialization in issues related to natural and anthropogenic pollution in the natural environment with an either chemical or biological main approach, but with a solid basis in both chemistry and biology. The programme will provide a thorough insight into the processes and mechanisms related to how environmental toxicants are absorbed by organisms, dispersal mechanisms locally and globally, how they are distributed and transported in ecosystems, how they can be monitored, and the effects that environmental toxicants have on cells, organs, organisms, populations and ecosystems. Depending on the main approach, the programme will also provide insight and practical experience in methodology and analytical techniques of relevance for working with issues within environmental chemistry and environmental toxicology. The study also focuses on the dissemination of research results to a wide audience.

Knowledge
After finishing the study programme, the candidate should have acquired

- wide academic and applied knowledge in biology and/or chemistry with specialization in the field of Environmental Toxicology and/or Environmental Chemistry.
- knowledge of chemical properties of different groups of compounds and biological effects and important cycles, as basis for a comprehensive understanding of climate/environment, pollution and toxicology.
- knowledge of the physicochemical and/or biophysical processes of importance to the natural environment.
- research experience in a speciality that requires advanced knowledge of biology and/or chemistry through a supervised master's project that extends over several semesters.
- knowledge of relevant methods and hypothesis testing, including experimental analysis (chemical and/or biological), statistical techniques and other tools used to analyze and solve biological and/or chemical issues in research, manufacturing, management and/or teaching.
- knowledge of international research in her/his speciality, knowledge of international research groups in the field, and the breadth of research being done in the fields of

"Environmental Toxicology" and "Environmental Chemistry".

Skills
After finishing the study programme, the candidate should

- have professional knowledge of and be able to utilize a variety of advanced quantitative and qualitative analysis methods, methodology in the field and the application of these to independently analyze and solve (modelling) toxicological and/or chemical problems.
- be able to collect and analyze environmental samples, perform statistical analysis of data and interpretation and presentation of research results.
- combine insights from several scientific disciplines.
- make critical and independent assessments of methods and results.
- continuously develop his/her professional competence.
- be able to communicate subject matter and scientific results both to specialists and to a wider audience and be able to formulate scientific reasoning/argumentation.
- have expertise in handling chemical substances and/or biological material and understand environmental issues, including EHS.

General competence
After finishing the study programme, the candidate should

- know important aspects in environmental pollution, understand this discipline's role in society and be able to assess ethical issues within this field.
- be able to acquire, evaluate and adopt relevant and reliable new information.
- have the background to carry out/solve advanced tasks and projects, both independently and in teams, and have the ability to assess her/his own efforts in projects.
- have an international perspective on her/his scientific field.

Career prospects
Graduates of the Masters programme will be internationally qualified for a wide range of positions in public and government institutions, administrative environmental agencies, consultancy companies and industry (e.g. oil and energy companies and the chemical industry) both as researcher or adviser. Some examples are Statoil and other oil companies, Det Norske Veritas, SINTEF or other research institutes/consulting firms, and national environmental authorities. Furthermore, there is an increasing need for competence within the area of risk assessment (REACH).

Through this programme you will be part of a large international scientific and industrial network. The candidates in environmental toxicology can after five years of work experience apply to become a "European Registered Toxicologist".

Admission requirements

One of the following requirements has to be fulfilled to qualify for admission to the programme:

- To qualify for the specialisation in Environmental Toxicology: BSc in Biology (minimum of 80 ECTS credits biology courses) including pollution biology. In addition, applicants must have basic knowledge in chemistry.
- To qualify for the specialisation in Environmental Chemistry: BSc in Chemistry (minimum of 80 ECTS credits chemistry courses) including environmental and/or analytical chemistry. In addition, applicants must have basic knowledge in mathematics.
- Bachelor degrees within other related areas may be considered on an individual basis. The candidate's background should provide a biological and/or chemical relevant basis for the master study in Environmental Toxicology and Chemistry (e.g. courses listed below in the bachelor degrees at NTNU forming the basis for this master study).

In the following tables you will find the admission requirements for NTNU BSc students. Compulsory courses are written in bold.

BSc in Chemistry:

Year	Semester				
3	6. Spring	KJ2072 Environmental Chemistry	KJ2073 Analytical Environmental Chemistry	**TKJ4150 Organic Synthesis I**	**KJ20XX Bachelor project**
	5. Autumn	**KJ1041 Chemical Bonds, Spectroscopy and Kinetics**	TBT4102 Biochemistry	GEOL1003 Geology and the Environment	BI2050 Biological resources
2	4. Spring	**KJ1042 Basic Thermodynamics with Laboratory**	**KJ2022 Spectroscopic Methods in Organic Chemistry**	**KJ2053 Chromatography**	**FY0001 Service Course in Physics**
	3. Autumn	**Perspective Course**	**KJ2050 Analytical Chemistry, Basic Course**	**ST0103 Statistics with Applications**	**KJ2031 Inorganic Chemistry, Advanced Course**
1	2. Spring	**TMT4130 Inorganic Chemistry**	**MA0002 Mathematical Methods B**	**KJ1020 Organic Chemistry**	
	1. Autumn	**EXPH0001 Philosophy and Theory of Science**	**MA0001 Mathematical Methods A**	**KJ1000 General Chemistry**	
ECTS Credits:		7,5	7,5	7,5	7,5

Students admitted to BSc in Chemistry, NTNU, before 2013 follows the relevant study plans

from the year they were accepted (plan for 2010-2011, 2011-2012 or 2012-2013). Hence, this table applies for the classes from 2013 onwards. NTNU-students completing their BSc in Chemistry, specialization in environmental- and analytical chemistry according to the study plans from 2010-2011 or 2011-2012 are therefore qualified for admission autumn 2014.

BSc in Biology, Cell and Molecular Biology:

Year	Semester				
3	6 Spring	**BI2071 Pollution Biology**		**ST2304 Statistical modelling for biologists/biotechnologists**	**KJ2072 Environmental Chemistry**
	5 Autumn	**BI2014 Molecular Biology**	**BI2015 Molecular Biology, Laboratory Course**	**ST0103 Statistics with Applications**	KJ2050 Analytical Chemistry, Basic Course/Elective course
2	4 Spring	**Perspective course**	**BI2012 Cell Biology**	**KJ1020 Organic Chemistry**	
	3 Autumn	**BI1004 Physiology**		**MA0001 Mathematical Methods A**	**EXPH0004 Philosophy and Theory of Science**
1	2 Spring	**BI1001 Cell and Molecular Biology**		**BI1002 Faunistics and Floristics in Norwegian Ecosystems**	
	1 Autumn	**BI1003 Evolutionary Biology, Ecology and Ethology**		**KJ1000 General Chemistry**	
ECTS Credits:		7,5	7,5	7,5	7,5

BSc in Biology, Physiology:

<table>
<tr><td>Year</td><td>Semester</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">3</td><td>6 Spring</td><td colspan="2">BI2071
Pollution Biology</td><td>ST2304
Statistical modelling for biologists/biotechnologists</td><td>KJ2072
Environmental Chemistry,</td></tr>
<tr><td>5 Autumn</td><td colspan="2">BI2020
Zoo-Physiology
or
BI2021 Plant Ecophysiology
or
BI2022
Plant Growth and Development</td><td>ST0103
Statistics with Applications</td><td>BI2014 Molecular Biology/KJ2050 Analytical Chemistry, Basic Course</td></tr>
<tr><td rowspan="2">2</td><td>4 Spring</td><td>Perspective course</td><td>BI2012
Cell Biology</td><td colspan="2">KJ1020
Organic Chemistry</td></tr>
<tr><td>3 Autumn</td><td colspan="2">BI1004
Physiology</td><td>MA0001
Mathematical Methods A</td><td>EXPH0004
Philosophy and Theory of Science</td></tr>
<tr><td rowspan="2">1</td><td>2 Spring</td><td colspan="2">BI1001
Cell and Molecular Biology</td><td colspan="2">BI1002
Faunistics and Floristics in Norwegian Ecosystems</td></tr>
<tr><td>1 Autumn</td><td colspan="2">BI1003
Evolutionary Biology, Ecology and Ethology</td><td colspan="2">KJ1000
General Chemistry</td></tr>
<tr><td colspan="2">ECTS Credits:</td><td>7,5</td><td>7,5</td><td>7,5</td><td>7,5</td></tr>
</table>

Information about the Master's Study

Workload and structure

The programme requires two years of full-time study, beginning with the autumn term (medio August). The normal work load for a full-time student for one academic year is 60 ECTS credits.

The Master's study consists of two parts:

1. A written thesis of the project (Master thesis). The extent of the assignment should correspond to a work load of 60 credits. The work on the thesis is time limited. The thesis has to be submitted within May 15th of the 2nd year.
2. An approved selection of courses, a minimum of total 60 credits, from what (at least) 30 credits must be courses at 3000-level (master level) (UTF§14.1).

Master's agreement

Every master student has to make a Master's agreement. This agreement comprises your syllabus and master project together with regulations for the counseling given during the master's study. The subjects, compulsory or elective, stated as syllabus in your Master's

agreement cannot be changed. If there for serious reason develops a need for change, the Master's agreement must be revised. The supervisor, the responsible Department and the student must agree upon the revision and the new agreement filed.

The Master thesis

The Master thesis should be developed as your own original work (with some support from your adviser). Any quotation, use of data, information etc from other sources (including the scientifically literature and your fellow students) should therefore be carefully listed and included in the reference list of your thesis, according to best practice within your field of study.

Submission and Examination

The student has to:

- Register for the final master's degree exam (through STUDWEB) within February the 15th of the 2nd academic year
- Apply for approval of your individual special syllabus (KJ3091 or KJ3093 for students in Environmental Chemistry/BI3091 or BI3093 for students in Environmental Toxicology). It is important that this is done well in advance of the examination. A study committee will evaluate the syllabus, and if it is not accepted, you must change it. Your supervisor must approve and sign the form. Hand in the thesis (within the deadline given, see below) for print through DAIM .The Department will give you 5 copies of the thesis. At the Department of Biology, the special syllabus exam (and similar special curriculum courses) can be arranged at the same day as the final master exam or at an earlier stage in the master programme. At the Department of Chemistry, the special syllabus exam (and similar special curriculum courses) can be arranged at the same day as the final master exam or within two weeks before the final master exam.

In addition to the judgment of thesis, the candidate will have an oral exam consisting of:

- A conversation on/presentation ("defence") of the research assignment (the master thesis)
- Examination on the special syllabus of the advanced courses which has previously not been evaluated during the study (at least 7,5 credits, preferentially individual special syllabus). All exams, except the special syllabus (if any) have to be passed before the date of the final Master's Degree exam, unless otherwise stated in your Master's agreement.

A grade is given for every course/special syllabus that constitutes a part of the exam.

Important deadlines

- **15th of October (1st year)**: Decide on a Master's project in cooperation with the supervisor.
- **15th of October (1st year)** Register your Master's agreement in DAIM and hand in the signed agreement, a project description and risk assessment of the project.

- **15th of February (2nd year):** Deadline for registration for the final Master's Degree exam (through STUDWEB)
- **15th of May (2nd year)**. Deadline for the submission of the master thesis. If the thesis is not submitted within this date the grade "not passed" will be awarded, unless there is handed in an application for extension of the deadline in reasonable time before the deadline. The reasons given in the application must be in accordance with Supplementary Regulations for the Natural Sciences (UTF) § 20.3 and the Examination Regulations at NTNU, § 20. Alternatively such an application may be dealt with, taken into consideration The Supplementary Regulations for the Natural Sciences (UTF) § 7 and the Examination Regulations at NTNU, § 7. See below for further information regarding §7 and §23.3.
- **15th of June (**approximately**, 2nd year)**: is the date for the final Master's Degree exam. (Individual agreement with the respective Department, approximately four weeks after the thesis is submitted).

Leave of absence from the Master Study (UTF § 7) (extract):

a) Leave of absence from the master studies of two years of duration and from the two last year of master studies of five years of duration is normally not granted.
b) Leaves of absence may nevertheless be granted when applied for and compelling circumstances are present. Such circumstances might be illness (yourself or among close family member) etc.

Prolongation of the study (UTF § 20.3) (extract):
The master thesis is time limited. In case of illness, the deadline for handing in the thesis can be postponed equivalent to the time of absence due to illness. The illness must be documented by medical certificate.

If there is a valid reason for not handing in the thesis in time, one can apply for up to three months prolongation of the deadline. If the thesis is not handed in within the extended deadline, a new extension must be applied for, or else the candidate is regarded failed. Delay of deadline can only be applied for twice.

Valid reasons for postponement (in addition to illness) is teaching, organized student activity, social work and unmerited problems concerning the thesis. Written documentation or statement is required, in addition to a new plan of completion. The Faculty, or Department when given the assignment by the Faculty, determines the application. When the reason for delay is teaching, organized student activity or social work, the extended time given is according to the time spent on these activities.

The agreed delay has no influence on the evaluation of the thesis.

Programme Structure and Specialisations

A diverse team of scientists is ready to offer you a two year international, interdisciplinary Master's programme in close collaboration with SINTEF and Statoil. You will work in a group incorporating both Norwegian and international students. All teaching is in English. The programme also offers you the opportunity to experience one semester in the University Centre in Svalbard (UNIS). Svalbard is an island archipelago situated in the heart of the Arctic.

There are two areas of scientific specialisation in this Masters programme:

Environmental Chemistry
Environmental Toxicology

Below you will find tables and lists of courses that describe the programme structure for each of these specialisations. The final structure of the course will be individually selected by each student allowing you to create the study programme most suited to your interests and skills. Advice will be given by the course administrators if required, and all study plans must be approved by the respective department.

You will find the course descriptions at the following web sites:
NTNU courses: http://www.ntnu.no/studies/courses
UNIS courses: http://www.unis.no/10_STUDIES/1020_Courses/

Environmental Chemistry:

1) For students spending all semesters at NTNU:

Year	Semester				
2	4 Spring NTNU:	**KJ3091 (7,5 ECTS) Special syllabus for Master's degree**	Master thesis		
	3 Autumn NTNU:	KJ3051 (7,5 ECTS) Ocean Space: Marine Biogeochemical Processes	Master thesis		
1	2 Spring NTNU:	**Experts in Team Work (7,5 ECTS)**	Elective course (7,5 ECTS)	Master thesis	
	1 Autumn NTNU:	**KJ3050[1] (7,5 ECTS) Organic Marine Environmental Chemistry**	KJ3072 (7,5 ECTS) Advanced Aquatic Chemistry	Elective course	**RFEL3070[2] (7,5 ECTS) Scientific Seminars in Pollution**
ECTS Credits		7,5	7,5	7,5	7,5

[1] KJ3050 requires previous knowledge in general chemistry corresponding to KJ1000 and a basic course in analytical chemistry (e.g. KJ2050).
[2] The students have to follow the RFEL3070 course in all semesters at NTNU.

Compulsory courses (written in bold in the table):
KJ3050[1] Organic marine environmental chemistry (7,5) (Autumn)
REFEL3070 Scientific Seminars in Pollution (7,5) (All semesters)
Experts in team work (7,5) (Spring)
KJ3091 Special syllabus for Master's degree (7,5) (Last semester)

Elective courses:
KJ2050[1] Analytical Chemistry, Basic Course (7,5) (Autumn)
KJ3051 Ocean Space: Marine Biogeochemical Processes (7,5) (Autumn)
KJ3053 Analytical methods for industrial- and environmental monitoring (7,5) (Autumn)
KJ3059 Advanced Chromatography (7,5) (Autumn)
KJ3072 Advanced Aquatic Chemistry (7,5) (Autumn)
BI3071 Advanced Ecotoxicology (7,5) (Autumn)
BI3072 Environmental Toxicology (7,5) (Autumn)
(TKJ4175 Chemometrics (7,5) (Spring) is recommended previous knowledge for KJ3053).

2) For students spending the second semester at UNIS:

<table>
<tr><td>Year</td><td>Semester</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">2</td><td>4 Spring NTNU:</td><td>KJ3091/KJ3093 (7,5/10 ECTS) Special syllabus for Master’s degree</td><td colspan="3">Master thesis</td></tr>
<tr><td>3 Autumn NTNU:</td><td>Elective course/ Master thesis</td><td colspan="3">Master thesis</td></tr>
<tr><td rowspan="2">1</td><td>2 Spring UNIS:</td><td colspan="3">AT-324 (10 ECTS) Techniques for the Detection of Organo-Chemical Pollutants in the Arctic Environment[3)]
and/or
AT-330 (10 ECTS) Arctic Environmental Toxicology[3)]
and/or
AT-331 (10 ECTS) Arctic Environmental Pollution: Atmospheric Distribution and Processes[3)]</td><td>Elective course/ Master thesis</td></tr>
<tr><td>1 Autumn NTNU:</td><td>KJ3050[1)] (7,5 ECTS) Organic Marine Environmental Chemistry</td><td>KJ3072 (7,5 ECTS) Advanced Aquatic Chemistry</td><td>Elective course/ Master thesis</td><td>RFEL3070[2)] (7,5 ECTS) Scientific Seminars in Pollution</td></tr>
<tr><td colspan="2">ECTS Credits</td><td>7,5</td><td>7,5</td><td>7,5</td><td>7,5</td></tr>
</table>

[1)] KJ3050 requires previous knowledge in general chemistry corresponding to KJ1000 and a basic course in analytical chemistry (e.g. KJ2050).
[2)] The students have to follow the RFEL3070 course in all semesters at NTNU.
[3)] Students spending the second semester at UNIS must take at least two of the three courses offered (AT-324, AT-330 and AT-331) and not be able to follow the intensive EiT to get exempted from Experts in Team Work at NTNU. For students also doing corresponding field work at Svalbard, special agreements can be made according to the rules for exception from EiT.

Compulsory courses (written in bold in the table):
KJ3050[1)] Organic marine environmental chemistry (7,5) (Autumn)
REFEL3070 Scientific Seminars in Pollution (7,5) (All semesters)

Two of the three following courses offered at UNIS (total of 20 ECTS):
AT-324 Techniques for detection of organo-chemical pollutants in the arctic environment (10) (Spring)
AT-330 Arctic Environmental Toxicology (10) (Spring)
AT-331 Arctic Environmental Pollution: Atmospheric Distribution and Processes (10) (Spring)

KJ3091 Special syllabus for Master's degree (7,5) (last semester)
or
KJ3093 Special syllabus for Master's degree (10) (last semester) only for those who follow 2 of the 3 courses at UNIS
KJ3091 Special syllabus exam (or KJ3093) can be held together with the final master exam or within two weeks of the master exam.

Elective courses:
KJ2050[1)] Analytical Chemistry, Basic Course (7,5) (Autumn)
KJ3051 Ocean Space: Marine Biogeochemical Processes (7,5) (Autumn)
KJ3053 Analytical methods for industrial- and environmental monitoring (7,5) (Autumn)
(TKJ4175 Chemometrics (7,5) (Spring) is recommended previous knowledge for KJ3053).
KJ3059 Advanced Chromatography (7,5) (Autumn)
KJ3072 Advanced Aquatic Chemistry (7,5) (Autumn)
BI3071 Advanced Ecotoxicology (7,5) (Autumn)
BI3072 Environmental Toxicology (7,5) (Autumn)

Environmental toxicology:

1) For students spending all semesters at NTNU:

Year	Semester				
2	4 Spring NTNU:	**BI3091 (7,5 ECTS) Special syllabus for Master's degree**	Master thesis		
	3 Autumn NTNU:	**BI3075 (7,5 ECTS) Experimental Ecotoxicology**	Elective course (7,5 ECTS)	Master thesis	
	2 Spring NTNU:	**Experts in Team Work (7,5 ECTS)**	BI3073 (7,5 ECTS) Genetic Toxicology	Master thesis	
	1 Autumn NTNU:	**BI3071 (7,5 ECTS) Advanced Ecotoxicology**	**BI3072 (7,5 ECTS) Environmental Toxicology**	**RFEL3070[1)] (7,5 ECTS) Scientific Seminars in Pollution**	Master thesis
ECTS Credits		7,5	7,5	7,5	7,5

[1)] The students have to follow the RFEL3070 course in all semesters at NTNU.

Compulsory courses:
RFEL3070 Scientific Seminars in Pollution (7,5) (All semesters)
BI3071 Advanced Ecotoxicology (7,5) (Autumn)
BI3072 Environmental Toxicology (7,5) (Autumn)
Experts in Team Work (7,5) (Spring)

BI3075 Experimental Ecotoxicology (7,5) (Autumn)
BI3091 Special syllabus for Master's degree (7,5) (last semester)

Elective courses:
BI3073 Genetic Toxicology (7,5) (Spring)
KJ2050 Analytical Chemistry, Basic Course (7,5) (Autumn)
KJ3050 Organic marine environmental chemistry (7,5) (Autumn)

(KJ3050 requires previous knowledge in general chemistry corresponding to KJ1000 and a basic course in analytical chemistry (e.g. KJ2050)

2) For students spending the second semester at UNIS:

<table>
<tr><td>Year</td><td>Semester</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">2</td><td>4 Spring NTNU:</td><td>BI3091/BI3093 (7,5/10 ECTS) Special syllabus for Master's degree</td><td colspan="3">Master thesis</td></tr>
<tr><td>3 Autumn NTNU:</td><td>BI3075 (7,5 ECTS) Experimental Ecotoxicology</td><td colspan="3">Master thesis</td></tr>
<tr><td rowspan="2">1</td><td>2 Spring UNIS:</td><td colspan="3">AT-324 (10 ECTS) Techniques for the Detection of Organo-Chemical Pollutants in the Arctic Environment[2)]
and/or
AT-330 (10 ECTS) Arctic Environmental Toxicology[2)]
and/or
AT-331 (10 ECTS) Arctic Environmental Pollution: Atmospheric Distribution and Processes[2)]</td><td>Master thesis</td></tr>
<tr><td>1 Autumn NTNU:</td><td>BI3071 (7,5 ECTS) Advanced Ecotoxicology</td><td>BI3072 (7,5 ECTS) Environmental Toxicology</td><td>RFEL3070[1)] (7,5 ECTS) Scientific Seminars in Pollution</td><td>Master thesis</td></tr>
<tr><td colspan="2">ECTS Credits</td><td>7,5</td><td>7,5</td><td>7,5</td><td>7,5</td></tr>
</table>

[1)] The students have to follow the RFEL3070 course in all semesters at NTNU.
[2)] Students spending the second semester at UNIS must take at least two of the three courses offered (AT-324, AT-330 and AT-331) and not be able to follow the intensive EiT to get exempted from Experts in Team Work at NTNU. For students also doing corresponding field work at Svalbard, special agreements can be made according to the rules for exception from EiT.

Compulsory courses:
RFEL3070 Scientific Seminars in Pollution (All semesters)
BI3071 Advanced Ecotoxicology (Autumn)
BI3072 Environmental Toxicology (Autumn)
BI3075 Experimental Ecotoxicology (Autumn)

Two of these courses offered at UNIS (total of at least 20 ECTS):
AB-203 Arctic Environmental Management (15) (Spring)
AB-323 Light, Climate and Primary Production in the Arctic (10) (Spring)
AT-324 Techniques for Detection of Organo-chemical Pollutants in the Arctic Environment (10) (Spring)
AT-330 Arctic Environmental Toxicology (10) (Spring)
AT-331 Arctic Environmental Pollution: Atmospheric Distribution and Processes (10) (Spring)
BI3091 Special syllabus for Master's degree (7,5)
or
BI3093 Special syllabus for Master's degree (10) only for those who follow 2 of the 3 courses at UNIS

BI3091 Special syllabus exam (and similar special curriculum courses) can be held together with the final master exam or at an earlier stage in the master programme.

Examples of Master Theses

- Developing and establishing analytical methods and tools for use in environmental monitoring of marine and coastal areas, including quality assurance of these methods.
- Impacts of oil and gas activities on the marine environment, including biomonitoring and studies of harmful effects on invertebrates and fish.
- Distribution of brominated flame retardants in nature, including their bioaccumulation and toxicological effects in different organisms.
- Long-range atmospheric transport, deposition and effects of trace metals (e.g. lead, mercury, cadmium) in air, snow, soil, water, and ecosystems. An example of this is the chemistry of mercury in the Arctic after polar sunrise.
- Occurrence of environmental pollutants in complex mixtures. To increase the understanding of their interaction, in vitro studies are carried out, in which cells are exposed to individual toxicants and mixtures of known environmental pollutants (e.g. PAHs, PCBs, trace metals)
- Fate and effects of crude oil in the marine environment following accidental and chronic releases. The behavior of spilled oil in the environment and the use of analytical chemical methods for oil spill identification and monitoring.

Contact information and counselling

Address: NTNU, Faculty for Natural Sciences and Technology, 7491 Trondheim, Norway
Telephone: 73 59 41 97
E-mail: studier-nt@nt.ntnu.no
URL: http://www.ntnu.no/nt/english
http://www.ntnu.edu/studies/msenvitox

Study advisors:

Siri Bremdal +47 73 59 45 52
Lisbeth Aune +47 73 59 62 73
Thea Berg Fines +47 73 55 13 40

MASTER OF SCIENCE IN PHYSICS

Programme code: MSPHYS

Degree Programme

In physics we try to reveal the secrets of nature, from the microcosm of elementary particles to the macrocosm of astrophysics. Between these two extremes there is a wealth of subjects, ranging from biophysics at cellular level and medical research to the development of new understanding in fields such as nanotechnology and climate. At present, these and many other areas are advancing in exciting ways.

Specializations

In general, the specializations are:
- Astro and Particle Physics and Modern Field Theory
- Biophysics and Medical Physics
- Energy and Environmental Physics
- Optics and Condensed Matter Physics

Additional information about the specializations are found on the programme's webpages, http://www.ntnu.edu/studies/msphys

Admission Requirements

For admission to the programme, you are required to hold a Bachelor's degree in physics, equivalent to 180 ECTS credits. Alternatively, you may be admitted with a Bachelor's degree not in physics, but with a sufficient formal background in calculus based physics (a minimum of 80 ECTS credits) and mathematics (a minimum of 30 ECTS credits).

Learning Objectives

The Master of Science in Physics programme provides the candidate with knowledge, general competence, and analytical skills on an advanced level, needed in industry, consultancy, education, research, or public administration.

The work with the Master Thesis gives special expertise within one of the research areas represented at The Department of Physics: Astro and Particle Physics and Modern Field Theory, Biophysics and Medical Physics, Energy and Environmental Physics, and Optics and Condensed Matter Physics.

Knowledge

The candidate

- has substantial knowledge in physics, basic knowledge in mathematics, and knowledge in supported fields like computer science.
- has some research experience within a specific field of physics, through a supervised project (the Master Thesis).
- has advanced knowledge in some areas in physics.
- is familiar with contemporary research within various fields of physics.

Skills

The candidate

- has the background and experience required to model, analyse, and solve advanced problems in physics.
- is able to apply advanced theoretical and/or experimental methods, including the use of numerical methods and simulations.
- can combine and use knowledge from several disciplines.
- can critically and independently assess and evaluate research methods and results.
- has the ability to develop and renew scientific competence -- independently, via courses or through PhD studies in physics or related disciplines.
- is able to enter new problem areas that require an analytic and innovative approach.
- can disseminate subject matter and results to both specialists and a broader audience.

General competence

The candidate

- understands the role of physics in society and has the background to consider ethical problems.
- knows the historical development of physics, its possibilities and limitations, and understands the value of lifelong learning.
- is able to gather, assess, and make use of new information.
- has the ability to successfully carry out advanced tasks and projects, both independently and in collaboration with others, and also across disciplines.
- has an adequate background for pursuing pedagogic education.
- has an international perspective on her/his discipline.

Study plan for Master of Science in Physics

<table>
<tr><th colspan="5">Courses and ECTS Credits</th></tr>
<tr><th></th><th>7.5</th><th>7.5</th><th>7.5</th><th>7.5</th></tr>
<tr><td>2nd year
4th semester
Spring</td><td colspan="4">Master Thesis</td></tr>
<tr><td>2nd year
3rd semester
Autumn</td><td>Elective course</td><td>Elective course
or
Special Curriculum</td><td colspan="2" rowspan="3">Master Thesis</td></tr>
<tr><td>1st year
2nd semester
Spring</td><td>Elective course</td><td>Elective course</td><td>Experts in Teamwork</td></tr>
<tr><td>1st year
1st semester
Autumn</td><td>Elective course</td><td>Elective course</td><td>Elective course</td></tr>
</table>

The distribution of elective courses over the four semesters may be modified, in agreement with the supervisor.

Examination: The courses may have different examination forms, but most often an examination, oral or written, will be arranged at the end of the semester in which the course is offered.

For most examinations, including the thesis, the scale of grading is from A (highest) to E (lowest), or F (fail). Some courses are graded with “passed” or “not passed”/”failed”.

Resit Examination: All courses starting with the code FY and TFY have a resit examination in August. The ordinary examination is only held at the end of the semester the course is lectured. The resit examination is arranged only for candidates that can document approved absence or candidates that obtained the grade F or Failed at the ordinary examination.

Exchange Studies: It is possible to do studies at other universities during the Master’s Programme. Exchange studies have to be planned in collaboration with the supervisor, and approved by The Faculty of Natural Sciences and Technology. If exchange studies are considered, they are recommended to be done in the second semester. Exchange studies in the spring semester gives exemption from Experts in Teamwork.

Information about the Master’s Study

Workload and structure

The programme requires two years of full-time study, beginning with the autumn term (medio August). The normal work load for a full-time student for one academic year is 60 ECTS credits.

The Master's study consists of two parts:

1. A written thesis of the project (Master thesis). The extent of the assignment should correspond to a work load of 60 credits. The work on the thesis is time limited. The thesis has to be submitted within May 15th of the 2nd year.
2. An approved selection of courses, a minimum of total 60 credits, from what (at least) 30 credits must be courses at 3000-level (master level) (UTF§14.1).

Master’s agreement

Every master student has to make a Master’s agreement. This agreement comprises your syllabus and master project together with regulations for the counseling given during the master’s study. The subjects, compulsory or elective, stated as syllabus in your Master’s agreement cannot be changed. If there for serious reason develops a need for change, the Master’s agreement must be revised. The supervisor, the responsible Department and the student must agree upon the revision and the new agreement filed.

The Master thesis

The Master thesis should be developed as your own original work (with some support from your adviser). Any quotation, use of data, information etc. from other sources (including the scientifically literature and your fellow students) should therefore be carefully listed and included in the reference list of your thesis, according to best practice within your field of study.

Submission and Examination

The student has to:

- Register for the final master's degree exam (through STUDWEB) within February the 15th of the 2nd academic year
- Apply for approval of your individual special syllabus. It is important that this is done well in advance of the examination. A study committee will evaluate the syllabus, and if it is not accepted, you must change it. Your supervisor must approve and sign the form.
- Hand in the thesis (within the deadline given) for print through DAIM .The Department will give you 5 copies of the thesis.

In addition to the judgment of thesis, the candidate will have an oral exam consisting of:

- A conversation on/presentation ("defence") of the research assignment (the Master's Thesis)
- Examination on the special syllabus of the advanced courses which has previously not been evaluated during the study (at least 7,5 credits, preferentially individual special syllabus). All exams, except the special syllabus (if any) have to be passed before the date of the final Master's Degree exam, unless otherwise stated in your Master's agreement.

A grade is given for every course/special syllabus that constitutes a part of the exam.

Important deadlines

- **15th of October (1st year)**: Decide on a Master's project in cooperation with the supervisor.
- **15th of October (1st year)** Register your Master's agreement in DAIM and hand in the signed agreement, a project description and risk assessment of the project.
- **15th of February (2nd year):** Deadline for registration for the final Master's Degree exam (through STUDWEB)
- **15th of May (2nd year)**. Deadline for the submission of the master thesis. If the thesis is not submitted within this date the grade "not passed" will be awarded, unless there is handed in an application for extension of the deadline in reasonable time before the deadline. The reasons given in the application must be in accordance with Supplementary Regulations for the Natural Sciences (UTF) § 20.3 and the Examination Regulations at NTNU, § 20. Alternatively such an application may be dealt with, taken into consideration The Supplementary Regulations for the Natural Sciences (UTF) § 7 and the Examination Regulations at NTNU, § 7 . See below for further information regarding §7 and §23.3.
- **15th of June (**approximately**, 2nd year)**: is the date for the final Master's Degree exam. (Individual agreement with the respective Department, approximately four weeks after the thesis is submitted).

Leave of absence from the Master Study (UTF § 7) (extract):

a) Leave of absence from the master studies of two years of duration and from the two last year of master studies of five years of duration is normally not granted.
b) Leaves of absence may nevertheless be granted when applied for and compelling circumstances are present. Such circumstances might be illness (yourself or among close family member) etc.

Prolongation of the study (UTF § 20.3) (extract):

The master thesis is time limited. In case of illness, the deadline for handing in the thesis can be postponed equivalent to the time of absence due to illness. The illness must be documented by medical certificate.

If there is a valid reason for not handing in the thesis in time, one can apply for up to three months prolongation of the deadline. If the thesis is not handed in within the extended deadline, a new extension must be applied for, or else the candidate is regarded failed. Delay of deadline can only be applied for twice.

Valid reasons for postponement (in addition to illness) is teaching, organized student activity, social work and unmerited problems concerning the thesis. Written documentation or statement is required, in addition to a new plan of completion. The Faculty, or Department when given the assignment by the Faculty, determines the application. When the reason for delay is teaching, organized student activity or social work, the extended time given is according to the time spent on these activities.

The agreed delay has no influence on the evaluation of the thesis.

Course list

The list below gives an overview of courses on 2000- and 3000-level offered by the Department of Physics. Detailed course information is available at http://www.ntnu.edu/physics/courses

Code	Name	Semester	Level
FY2045	Quantum Mechanics I	Autumn	2000
FY2290	Energy Resources	Spring	2000
FY2302	Biophysics I	Autumn	2000
FY2450	Astrophysics	Spring	2000
FY3006	Sensors and Transducers	Autumn	3000
FY3114	Functional Materials	Autumn	3000
FY3201	Atmospheric Physics and Climate Change	Spring	3000
FY3403	Particle Physics	Autumn	3000
FY3452	Gravitation and Cosmology	Spring	3000
FY3464	Quantum Field Theory I	Spring	3000
FY3466	Quantum Field Theory II	Autumn	3000
FY3490	Physics, Special Syllabus	Autumn/ Spring	3000
TFY4185	Measurement Techniques	Autumn	2000
TFY4190	Instrumentation	Spring	3000
TFY4195	Optics	Spring	3000
TFY4200	Optics, Advanced Course	Spring	3000
TFY4205	Quantum Mechanics II	Autumn	3000
TFY4210	Quantum Theory of Many-Particle Systems	Spring	3000
TFY4220	Solid State Physics	Spring	3000
TFY4225	Nuclear and Radiation Physics	Autumn	3000
TFY4230	Statistical Physics	Autumn	2000
TFY4235	Computational Physics	Spring	3000
TFY4240	Electromagnetic Theory	Autumn	2000
TFY4245	Solid State Physics, Advanced Course	Spring	3000
TFY4255	Materials Physics	Autumn	3000
TFY4260	Cell Biology and Cellular Biophysics	Spring	3000
TFY4265	Biophysical Micro Methods	Autumn	3000
TFY4275	Classical Transport Theory	Spring	3000
TFY4280	Signal Processing	Spring	3000
TFY4292	Quantum Optics	Autumn	3000
TFY4300	Energy and Environmental Physics	Autumn	2000
TFY4305	Nonlinear Dynamics	Autumn	3000
TFY4310	Molecular Biophysics	Autumn	3000
TFY4315	Biophysics of Ionizing Radiation	Spring	3000
TFY4320	Medical Physics	Spring	3000
TFY4330	Nano Tools	Spring	3000
TFY4335	Nano Life Science	Autumn	2000
TFY4340	Mesoscopic Physics	Spring	3000
TFY4345	Classical Mechanics	Spring	3000

Chemistry

Programme code: MSCHEM

Learning outcomes

Candidates completing the international Master of Science program in Chemistry should aquire knowledge, general competence and analytical skills at an advanced level targeting future employment in research (i.e PhD), industry, teaching or public administration. During the program students will chose one of the following topics for specialisation and master thesis; Applied Theoretical Chemistry, Organic Chemistry or Structural Chemistry.

Knowledge
Upon completing the master's degree the candidate will have
- in-depth chemical knowledge and research experience within a specialised field of chemistry through a supervised master project
- advanced chemical knowledge approaching state of the art research
- knowledge on relevant methods applied for solving analytical and chemical problems within topical research fields
- knowledge about international state of the art research in a specialised field

Skills
Upon completing the master's degree the candidate will be able to
- develop and implement innovative solutions to advanced chemical problems
- master a selection of advanced theoretical methods or experimental techniques
- combine chemical knowledge with other specialty fields such as physics, mathematics or biology
- perform independent critical assessments of methods and results
- continously improve and develop their research qualifications
- correctly dispose of and handle chemical substances in accordance with current health and safety regulations
- carry out an independent scientific project from hypothesis to collecting, analysing and interprerating data and final presentation both written and orally

General competence
Upon completing the master's degree the candidate will
- be able to acknowledge the role of chemistry as a research field within societal and historical perspectives
- recognize topical issues within the field of specialization
- be able to locate and utilize relevant information resources and carry out critical evaluation of sources and contents
- be able to disseminate knowledge and results to both peers and non-specialists
- be able to evaluate personal contributions in project related teamwork
- be able to carry out advanced tasks and projects both individually and as part of a possible interdisciplinary team

Learning outcome –specializations

Specific learning outcomes for each specialization add to the knowledge, skill and competence attained during the international master program in Chemistry.

Applied theoretical chemistry
Upon completing a master's degree the candidate will
- have profound knowledge about physical chemical principles and laws
- have advanced and research based knowledge of molecular modeling
- be able to analyze industrial situations and processes with background in physical chemical knowledge
- have profound knowledge about the laws of thermodynamics and how these can be used for system far from equilibrium.
- have profound knowledge about quantum chemistry methods and be able to apply these to simple molecular systems and determine properties of simple molecules.
- be able to carry out projects based using computational chemistry.
- be able to evaluate experimental results using chemometric and other physical chemistry methods.

Organic chemistry
Upon completing a master's degree the candidate will
- have theoretical knowledge of general reaction mechanisms in organic chemistry as well as practical skills in how to apply essential organic chemical reactions, including choice of reagents.
- be able to carry our advanced analysis to solve organic synthetic problems, including retro-synthesis, in order to make rational choices for synthesis strategy and reagents.
- be able to evaluate (H—M—S) aspects of practical operations and reagents.
- be able to plan and to carry out multi-step organic syntheses and optimization studies based on relevant mechanistic understanding.
- be able to find appropriate purification methods for diverse product mixtures, applying extraction, distillation, sublimation or chromatographic methods etc. for product isolation.
- be able to characterize and analyze products, mixtures of compounds and processes by different analysis techniques, such as spectroscopic (UV, IR, MS, NMR etc.) and chromatographic methods (GC, HPLC etc.)
- be able to extend knowledge in other relevant scientific fields, applying available literature, databases and net-based resources.

Structural chemistry
Upon completing a master's degree the candidate will
- have in depth knowledge about inorganic materials, their structure and applications
- be able to plan and carry out a parameter study for development of synthesis routes for functional materials
- be able to plan and carry out a characterization study of functional materials with main emphasis on spectroscopic techniques (XAS, FT-IR, UV-vis)
- be able to analyse and interpret spectroscopic data and relate results to the chemical structure
- have knowledge about some catalytic processes and their mechanism
- be able to deduce a structure activity relationship for inorganic functional materials

Career prospects

The goal of the MSc in Chemistry is to educate highly qualified chemists able to work independently with chemistry related issues at an advanced level. This will make you an attractive employee in a wide variety of fields.

By majoring in chemistry, you obtain knowledge about several issues important in today's society, such as environmental issues or developing new sources of energy, which will can lead to exiting and meaningful jobs. Today we find chemists in many fields including; industry, research, central and local government administrations and in teaching covering a wide range of specified topics. Within research, you can work at universities, different kinds of research institutes like SINTEF or in industry.

Examples of jobs that would be relevant for you with an MSc in Chemistry:

- Research position at Statoil, Reinertsen Engineering, Forsvarets forskningsinstitutt, SINTEF, Borregaard, Chiron, Alpharma, GE Healthcare, Axis-Shield, Statens legemiddelverk
- Research positions at universities in Norway or international universities
- Product managers in Sigma-Aldrich and VWR
- Laboratory managers in Napro-Pharma and Norsk Hydro
- Laboratory positions in hospitals and pharmacy companies
- Consultant positions in companies like Norconsult and Rambøll
- Teachers in high schools and colleges

Admission requirements

In the following table you will find the admission requirements for NTNU BSc students. Compulsory courses are written in bold.

BSc in Chemistry:

Year	Semester				
3	6. Spring	Elective course	Elective course	**TKJ4150 Organic Synthesis I**	**KJ20XX Bachelor project**
	5. Autumn	**KJ1041 Chemical Bonds, Spectroscopy and Kinetics**	Elective course	Elective course	Elective course
2	4. Spring	**KJ1042 Basic Thermodynamics with Laboratory**	**KJ2022 Spectroscopic Methods in Organic Chemistry**	**KJ2053 Chromatography**	**FY0001 Service Course in Physics**
	3. Autumn	**Perspective Course**	**KJ2050 Analytical Chemistry, Basic Course**	**ST0103 Statistics with Applications**	**KJ2031 Inorganic Chemistry, Advanced Course**
1	2. Spring	**TMT4130 Inorganic Chemistry**	**MA0002 Mathematical Methods B**	**KJ1020 Organic Chemistry**	
	1. Autumn	**EXPH0001 Philosophy and Theory of Science**	**MA0001 Mathematical Methods A**	**KJ1000 General Chemistry**	
ECTS Credits:		7,5	7,5	7,5	7,5

Students admitted to BSc in Chemistry, NTNU, before 2013 follows the relevant study plans from the year they were accepted (plan for 2010-2011, 2011-2012 or 2012-2013). Hence, this table applies for the classes from 2013 onwards. NTNU-students completing their BSc in Chemistry, specialization in applied theoretical chemistry, chemical structure and dynamics or organic chemistry with biochemistry according to the study plans from 2010-2011 or 2011-2012 are therefore qualified for admission autumn 2014.

NTNU BSc students under the regulations of the old study plan for BSc in Chemistry will also be qualified for admission until 2016-2017. Later, each applicant will be evaluated on an individually basis.

For students with a bachelor's degree from outside NTNU, the following admission requirements apply:

Bachelor in Chemistry (minimum of 80 ECTS credits chemistry courses), including basic courses in general, organic, inorganic, physical and analytical chemistry. You must have

good practical skills in the chemistry lab, and sufficient knowledge of experimental methods relevant for your specialization (for example chromatography and/or spectroscopy). It's also important that you have experience with writing scientific reports. In addition, applicants must have basic knowledge in mathematics and physics. Background in statistics is recommended.

The specializations are:

- Organic chemistry
- Applied theoretical chemistry
- Structural chemistry

The admission process and subsequent area of specialization will be based on individual evaluation of your academic background.

Information about the Master's Study

Workload and structure

The programme requires two years of full-time study, beginning with the autumn term (medio August). The normal work load for a full-time student for one academic year is 60 ECTS credits.

The Master's study consists of two parts:

1. A written thesis of the project (Master thesis). The extent of the assignment should correspond to a work load of 60 credits. The work on the thesis is time limited. The thesis has to be submitted within May 15th of the 2nd year.
2. An approved selection of courses, a minimum of total 60 credits, from what (at least) 30 credits must be courses at 3000-level (master level) (UTF§14.1).

Master's agreement

Every master student has to make a Master's agreement. This agreement comprises your syllabus and master project together with regulations for the counseling given during the master's study. The subjects, compulsory or elective, stated as syllabus in your Master's agreement cannot be changed. If there for serious reason develops a need for change, the Master's agreement must be revised. The supervisor, the responsible Department and the student must agree upon the revision and the new agreement filed.

The Master thesis

The Master thesis should be developed as your own original work (with some support from your adviser). Any quotation, use of data, information etc from other sources (including the scientifically literature and your fellow students) should therefore be carefully listed and included in the reference list of your thesis, according to best practice within your field of study.

Submission and Examination

The student has to:

- Register for the final master's degree exam (through STUDWEB) within February the 15th of the 2nd academic year
- Apply for approval of your individual special syllabus. It is important that this is done well in advance of the examination. A study committee will evaluate the syllabus, and if it is not accepted, you must change it. Your supervisor must approve and sign the form. Hand in the thesis (within the deadline given, see below) for print through DAIM .The Department will give you 5 copies of the thesis. At the Department of Chemistry, the special syllabus exam (and similar special curriculum courses) can be arranged at the same day as the final master exam or within two weeks before the final master exam.

In addition to the judgment of thesis, the candidate will have an oral exam consisting of:

- A presentation ("defence") of the research assignment (the master thesis) followed by a conversation on the thesis and presentation
- Examination on the special syllabus of the advanced courses which has previously not been evaluated during the study (at least 7,5 credits, preferentially individual special syllabus). All exams, except the special syllabus (if any) have to be passed before the date of the final Master's Degree exam, unless otherwise stated in your Master's agreement.

A grade is given for every course/special syllabus that constitutes a part of the exam.

Important deadlines

- **15th of October (1st year)**: Decide on a Master's project in cooperation with the supervisor.
- **15th of October (1st year)** Register your Master's agreement in DAIM and hand in the signed agreement, a project description and risk assessment of the project.
- **15th of February (2nd year):** Deadline for registration for the final Master's Degree exam (through STUDWEB)
- **15th of May (2nd year)**. Deadline for the submission of the master thesis. If the thesis is not submitted within this date the grade "not passed" will be awarded, unless there is handed in an application for extension of the deadline in reasonable time before the deadline. The reasons given in the application must be in accordance with Supplementary Regulations for the Natural Sciences (UTF) § 20.3 and the Examination Regulations at NTNU, § 20. Alternatively such an application may be dealt with, taken into consideration The Supplementary Regulations for the Natural Sciences (UTF) § 7 and the Examination Regulations at NTNU, § 7. See below for further information regarding §7 and §23.3.
- **15th of June (**approximately**, 2nd year)**: is the date for the final Master's Degree exam. (Individual agreement with the respective Department, approximately four weeks after the thesis is submitted).

Leave of absence from the Master Study (UTF § 7) (extract):

a) Leave of absence from the master studies of two years of duration and from the two last year of master studies of five years of duration is normally not granted.
b) Leaves of absence may nevertheless be granted when applied for and compelling circumstances are present. Such circumstances might be illness (yourself or among close family member) etc.

Prolongation of the study (UTF § 20.3) (extract):
The master thesis is time limited. In case of illness, the deadline for handing in the thesis can be postponed equivalent to the time of absence due to illness. The illness must be documented by medical certificate.

If there is a valid reason for not handing in the thesis in time, one can apply for up to three months prolongation of the deadline. If the thesis is not handed in within the extended deadline, a new extension must be applied for, or else the candidate is regarded failed. Delay of deadline can only be applied for twice.

Valid reasons for postponement (in addition to illness) is teaching, organized student activity, social work and unmerited problems concerning the thesis. Written documentation or statement is required, in addition to a new plan of completion. The Faculty, or Department when given the assignment by the Faculty, determines the application. When the reason for delay is teaching, organized student activity or social work, the extended time given is according to the time spent on these activities.

The agreed delay has no influence on the evaluation of the thesis.

Programme Structure and Specialisations

There are three areas of scientific specialisation in this Masters programme:

Applied Theoretical Chemistry
Organic Chemistry
Structural Chemistry

Applied theoretical chemistry

Applied theoretical chemistry is a field that covers many different areas. Common to these areas within chemistry is that they employ theoretical models, simulations and calculations to describe and predict chemical phenomena. In basic research, theoretical models are important because many of the interesting aspects take place on a scale that prevents the use of experimental tools. For example in quantum chemistry, the developement of computational methods has reached a level where we can achieve higher accuracy in calculations, than what is possible in spectroscopic experiments.

Also in the industry, the interest for theoretical methods is significant. By using simulations and modelling one can achieve increased insight into chemical processes and systems that can be harnessed, while avoiding expensive and time-consuming experiments.

Working with applied theoretical chemistry, you will have the opportunity to investigate a broad range of chemical systems through a variety of methods and angles. Regardless of the branch of applied theoretical chemistry one belongs to, a theoretical investigation follows a relatively similar procedure:

Development of a mathematical model that describes the chemistry of interest
Implementation of the mathematical model on a computer
Applying the software to investigate a relevant system
Analyze and process the large amounts of data generated

Students in our group can choose to focus on one or more of the steps in this chain. The knowledge and skills acquired are valuable in industry and research within all fields of interest.

Organic chemistry

Organic chemistry is the study of structures, properties, and reactions of organic compounds and organic materials. The range of applications of organic compounds is enormous and organic chemistry overlaps with many areas, including medicinal chemistry, biochemistry, organometallic chemistry, polymer chemistry and many aspects of materials science. Thus, in the modern society, knowledge within organic chemistry is required within a wide range of disciplines, as demonstrated by the fact that organic synthetic products serve as e.g. plastics, drugs, pharmaceuticals, pesticides, nano-molecular devices, food additives, pigments, flavorings, fibers, clothing, petrochemicals, explosives and paints. Additionally, organic chemistry deals with life and life processes, being associated with nearly every aspect of our existence. All the key molecules of life, such as DNA, proteins, lipids and carbohydrates, are organic compounds, furnishing the energy that sustains life.

Organic chemistry traditionally includes the chemistry of fuels. Currently, the activity is increasingly connected to energy related sciences, such as energy capture and storage. Due to environmental problems arising by unwanted consequences of organic chemicals

previously introduced to the environment, the development of environment-friendly (sustainable) processes has become an interesting and challenging field of organic chemistry.
Key subtopics presently covered by the activity at the Section of Organic Chemistry includes catalysis, organometallic chemistry, chemistry of polyenes, chemo- regio- and enantioselective synthesis, heterocyclic chemistry, fluoro-containing compounds and NMR. The application of analytical tools, such as advanced NMR and other spectroscopic and chromatographic techniques are important components of all these research activities.

Some current research projects are:

- Development of new cancer treatment agents by kinase inhibition;
- Synthesis of anti-bacterial agents based on marine natural products;
- Synthesis of polyenes, modification of polyenes, polyenes as gene carriers;
- Gold catalysed chemo-, regio- and enantioselective synthesis;
- Enzyme catalysed chemo-, regio- and enantioselective synthesis;
- New anti-inflammatory compounds from plant.

Through a master in Organic Chemistry, you will get an excellent knowledge of modern theoretical and experimental organic chemistry. Your master project will give you a solid background for planning and applying a variety of organic synthetic methods in experimental research projects. You will gain experience in how the outcome, yields and selectivity of your reactions may be improved by optimization of reaction conditions. Additionally, your investigations will give you important mechanistic understanding of the theoretical basis of organic processes.

Today, NTNU is the university in Norway educating most organic chemists, being regarded as skillful synthetic chemists and well trained within analytical organic chemistry. Organic chemists from NTNU work within industry, research and administration both in Norway and abroad.

Structural chemistry

In inorganic Structural Chemistry, we study the structure of advanced materials and their many interesting applications for important processes in today's society. At the Department of Chemistry we have focused our activities within what is commonly referred to as Materials Science, and relevant topics for a master thesis are structural studies of advanced functional materials. This means that we produce new materials such as the super-hydrophobic aerogels, currently used in space suits, or hierarchical zeotypes with mesopores functioning as super highways to transport gas molecules to micro-reactors inside the material. The structures of these materials give them unique properties as molecular sieves with functional surface or metal sites interesting for catalytic processes. We are currently studying new materials for catalytic conversion of diesel exhaust such as copper aerogels, and the use of bimetallic copper and gold nanoparticles in hierarchical zeotypes for the industrial process of selectively oxidization of propene.

Our goal is to develop synthesis routes for new exciting materials and then characterize these systems to obtain a fundamental understanding of the structure, and then explore their behavior during realistic working conditions. The materials are therefore characterized using a range of techniques, which you will be trained in. Our research lab houses an FT-IR coupled to a GC-MS and a catalysis rig for fundamental studies of these materials.

Our group is experienced in X-ray absorption spectroscopy, a technique which requires synchrotron radiation. We frequently travel to the European Synchrotron Radiation Facility (ESRF) in Grenoble – an international state of the art research facility supported and shared

by 18 countries. Synchrotron techniques represent an important tool-kit for studying nanoparticles and functional materials under operating conditions and the techniques available at the Swiss - Norwegian beamlines (SNBL) at ESRF are crucial for our projects. Previous MSc candidates in this group often continue with research at Universities or Institutes such as SINTEF, or start working in industries such as Life Technologies, Reinertsen, Statoil and GE Healtcare.

Below you will find a table and lists of courses that describe the programme structure for each of these specialisations. The final structure of the course will be individually selected by each student allowing you to create the study programme most suited to your interests and skills. Advice will be given by the course administrators if required, and all study plans must be approved by the respective department.

You will find the course descriptions at the following web sites:
http://www.ntnu.no/studies/courses

The programme requires two years of full-time study, beginning with the autumn term (mid August). The normal workload for a full-time student for one academic year is 60 ECTS credits.

Year	Semester	Course	Course	Course	Course
2	**Spring 4. semester**	**KJ3091 Special syllabus**			
	Autumn 3. semester	Elective course	**Master's Thesis**	**Master's Thesis**	**Master's Thesis**
1	**Spring 2. semester**	**Experts in Teamwork**	Elective course	Elective course	
	Autumn 1. semester	Elective course	Elective course	Elective course	
		7,5 ECTS	**7,5 ECTS**	**7,5 ECTS**	**7,5 ECTS**

There are two main components to the Masters programme:

- Masters thesis (60 ECTS credits)
- Theoretical and methodological courses, some compulsory and some elective (60 ECTS credits)

Compulsory courses:

- Experts in team work (7,5 credits, spring)
- KJ3091 Special syllabus for Master's degree (7,5 credits, last semester)

Elective courses:

There are recommended elective courses for each specialization. At least 30 ECTS credits of courses must be at the master level (3000-level), and the courses are chosen in

collaboration with the academic supervisor and the administration at the Department of Chemistry.

Recommended courses Applied theoretical chemistry:

TKJ4170 Quantum chemistry	(7,5 credits, spring)
TKJ4175 Chemometrics	(7,5 credits, spring)
TKJ4200 Irreversible thermodynamics	(7,5 credits, autumn)
TKJ4205 Molecular modelling	(7,5 credits, autumn)
TKJ4215 Statistical thermodynamics in chemistry and biology	(7,5 credits, spring)
KJ3021 Nuclear magnetic resonance spectroscopy	(7,5 credits, autumn)
KJ3053 Analytical methods for industrial and env. monitoring	(7,5 credits, autumn)
TKP4175 Thermodynamic methods	(7,5 credits, spring)
TFY4205 Quantum mechanics II	(7,5 credits, autumn)
TFY4210 Quantum theory of many-particle systems	(7,5 credits, spring)
TFY4235 Computational physics	(7,5 credits, spring)
TFY4255 Materials physics	(7,5 credits, autumn)
TFY4275 Classical transport theory	(7,5 credits, spring)
TFY4280 Signal processing	(7,5 credits, spring)
TFY4292 Quantum optics	(7,5 credits, autumn)
TFY4340 Mesoscopic physics	(7,5 credits, spring)
TFY4345 Classical mechanics	(7,5 credits, spring)
TMA4145 Linear methods	(7,5 credits, autumn)
TMA4205 Numerical linear algebra	(7,5 credits, autumn)
TMA4300 Computer intensive statistical methods	(7,5 credits, spring)

Recommended courses organic chemistry:

KJ3021 Nuclear Magnetic Resonance Spectroscopy	(7,5 credits, autumn)
TKJ4155 Organic synthesis II	(7,5 credits, autumn)
TKJ4180 Physical organic chemistry	(7,5 credits, autumn)
TKJ4175 Chemometrics	(7,5 credits, spring)
KJ3059 Chromatography, advanced course	(7,5 credits, autumn)
TKJ4205 Molecular modelling	(7,5 credits, autumn)
TBT4135 Biopolymers	(7,5 credits, autumn)
TKP4110 Chemical reaction engineering	(7,5 credits, spring)
TKP4115 Surface and colloid chemistry	(7,5 credits, autumn)
TKP4155 Reaction kinetics and catalysis	(7,5 credits, autumn)

Recommended courses structural chemistry:

TKP4155 Reaction kinetics and catalysis	(7,5 credits, autumn)
TMT4320 Nanomaterials	(7,5 credits, autumn)
TKP4190 Fabrication and applications of nanomaterials	(7,5 credits, spring)
TKP4515 Catalysis and petrochemistry, specialization course	(7,5 credits, autumn)
KJ3021 Nuclear magnetic resonance spectroscopy	(7,5 credits, autumn)
TKJ4175 Chemometrics	(7,5 credits, spring)
TKJ4200 Irreversible thermodynamics	(7,5 credits, autumn)
TKJ4205 Molecular modelling	(7,5 credits, autumn)
TMT4145 Ceramic engineering	(7,5 credits, autumn)
TMT4285 Hydrogen technology, fuel cells and solar cells	(7,5 credits, spring)
TKP4130 Polymer chemistry	(7,5 credits, spring)
TKP4150 Petrochemistry and oil refining	(7,5 credits, spring)

Contact information and counselling

Address: NTNU, Faculty for Natural Sciences and Technology, 7491 Trondheim, Norway
Telephone: 73 59 41 97
E-mail: studier-nt@nt.ntnu.no
URL: http://www.ntnu.no/nt/english
http://www.ntnu.edu/studies/msenvitox

Study advisors:

Kristin Omre +47 73 59 34 01
Siri Bremdal +47 73 59 45 52

MASTER'S PROGRAMME IN MATHEMATICAL SCIENCES 2014/15

INTRODUCTION

The Master's programme in mathematics is stipulated to take two years and builds on the three-year bachelor programme. The aim of the programme is to give the students a deep understanding of a specific field within mathematics or statistics, as well as practice in working independently. The programme is suitable for students with a genuine interest for mathematics, it being the theoretical aspect of the subject or its vast potential in applications.

LEARNING OBJECTIVES FOR THE MASTER'S PROGRAMMES

The Master's programmes in mathematics provide the students with an in-depth knowledge of a chosen mathematical area. The programme combines research based teaching in close collaboration with the civil engineering programmes and independent work with the help of modern mathematical/statistical literature and software. The degree provides the student with a strong background for future work in teaching and research, as well as in the public and private sector where a solid education within mathematics is required.

Knowledge

Upon graduation, the candidate has:

- a broad competence in mathematics, including mathematical analyses, algebra, numerical methods, topology, probability and statistics
- a solid knowledge in a chosen area within mathematics (corresponding to the student's specialization)
- depth knowledge in a specific field of mathematics, related to active research, including ability to understand and convey new results of research.

Skills

Upon graduation, the candidate is able to:

- use formal and stringent mathematical language in both theoretical and applied problem solving
- construct, analyse and communicate mathematical methods, models and arguments
- conduct independent research projects and present research results both verbally and in writing
- participate in interdisciplinary teamwork and implement relevant mathematical methods and models to problem solving

- asses their own adequacy, seek new sources of mathematical knowledge and to renew and develop their mathematical skills.

General competence

Upon graduation, the candidate is able to:

- follow the professional development within a mathematical field and is prepared to continuously strengthen their professional competency
- make informed choices in forming their own education

WORK OPPORTUNITIES

With a Master's degree in mathematics or statistics you are qualified to work in a variety of interesting jobs and sectors. Some of the sectors where your competence is needed include, among others, the oil industry, medicine, finance, research and teaching, both in the public and private sector. One can also choose to do a PhD in mathematics or statistics.

After a Master's degree in mathematics it is also possible to take one year of practical pedagogy studies, which allows you to teach at secondary level schools (provided you also have teaching competence corresponding to 60 ECTS in a second subject). There is a high demand for teachers with competence in mathematics in the secondary school, and the demand will continue to rise in the years to follow.

ADMISSION

The general rules regulating the admission to the Master's programme is described here: http://www.ntnu.no/documents/314472/0/DegreeProgr13-14.pdf/d3b5c8da-b205-4c84-8b49-2bc083a2349a

The specific criteria for admission to the Master's programme in mathematics are described below.

Both internal and external applicants must fulfil the following criteria for admission to the Master's programme:

- A Bachelor degree, cand.mag. degree or similar
- Fulfil criteria for a specialization (at least 80 ECTS in mathematics), where courses equivalent to the following must be included:
    - MA1101 Basic Calculus I (7.5 ECTS)

- MA1102 Basic Calculus 2 (7.5 ECTS)
- MA1103 Vector Calculus (7.5 ECTS)
- MA1201 Linear Algebra and Geometry (7.5 ECTS)
- MA1202 Linear Algebra with Applications (7.5 ECTS)

For the specializations in Algebra, Analysis and Topology, additional courses must be included:

- TMA4120 Calculus 4K (7.5 ECTS)
- MA2201 Algebra (7.5 ECTS)
- 2 courses in pure mathematics, where at least one must be on an intermediate level

For the specialization in Applied Mathematics, additional courses must be included:

- TMA4120 Calculus 4K (7.5 ECTS)
- MA2501 Numerical Methods (7.5 ECTS) or TMA4215 Numerical Mathematics (7.5 ECTS). The latter is specifically relevant for this specialization.

For this specialization it is also recommended with some knowledge in physics and informatics (programming)

For the specialization in Statistics at least 30 ECTS must be statistics courses, where the following courses must be included:

- ST1101 Probability and Statistics (7.5 ECTS)
- ST1201 Statistical Methods (7.5 ECTS)

In addition to one of the following courses:

- TMA4267 Linear Statistical Models (7.5 ECTS)
- TMA4265 Stochastic Processes (7.5 ECTS) or a different statistics course on the same level

The applicant must have a grade average of C in the courses required for admission. The grade average is calculated from both the obligatory and optional courses, in total 11 courses. In the case where the number of qualified applicants exceeds the number of spots available, the applicants will be ranked according to the rules determined by the NTNU.

PROGRAMME COMPONENTS

The Master's programme in mathematics is stipulated to take two years (120 ECTS). The programme consists of a Master's thesis of 45 ECTS and courses corresponding to a total of

75 ECTS. The duration of each course is usually one semester (7.5 ECTS) with 4 hours of lecture a week. Depending on capacity and need, there will be arranged reading courses, seminars and colloquies in order to aid students in their work with the Master's thesis.

Activities and examination procedures for each course is described on the course's information page, and may consist of a final exam (oral or written), midterm exam, exercises and/or project work.

When the Master's thesis has been submitted and all the courses included in the degree plan have been passed, the candidate must pass a final oral examination based on their Master's thesis (cf. § 23 in "Utfyllende regler for realfagsstudiene"). The presentation is public and should last for approximately 30 minutes. After the presentation, the candidate will receive their grade.

The Master's program offers specialization in five different fields: Algebra, Analysis, Topology, Applied Mathematics and Statistics. Within each field of study the student may choose between studies in applied mathematics or pure mathematics of this field. Common for all the specializations are requirements that the student chooses certain courses that are in the given specialization, but also that the student choses a certain amount of courses/credits from other fields of mathematics in order to achieve an in depth expertise in the field of specialization and a wide knowledge of mathematics in general.

The requirement to have a certain amount of courses/credits outside of the chosen specialization of the Master's program applies to the Bachelor program and Master's program combined. It's required to have four courses relevant to the specialization, each of 7.5 ECTS. These courses are specified for each specialization. The courses should be on a master level (higher level). In addition, the courses TMA4145 Linear Methods, TMA4212 Numerical Solution of Differential Equations by Difference Methods, TMA4165 Differential Equations and Dynamical Systems, TMA4275 Lifetime Analysis, TMA4265 Stochastic Processes and TMA4267 Linear Statistical Methods can be included. TMA4155 Cryptography, Introduction is on a master level, but cannot be included in the Master's degree. It's possible, and often advantageous, to take one or more of the courses in the field of specialization during the bachelor study.

The requirement for courses from other mathematical fields than the field of specialization applies to the Master's program in itself, and states that at least two mathematical courses on a master level (each of 7.5 ECTS) have to be outside of the specialization. In addition the course Experts in Team (7.5 ECTS) is mandatory and has to be taken within the first year of the master study.

The remaining courses are chosen from the ones offered by the department of mathematical sciences (provided they are on a master level), including courses from the technology and PhD programs. Courses offered by other departments may also be included in the Master's degree provided they are approved by the faculty. The students should contact the faculty at an early stage for approval of their degree plan.

Courses passed before admission to the master programme can only be included in the Master's degree upon approval of the faculty.

All students must include in their degree(s) (including credits taken during the bachelor program) at least 30 credits chosen from the following list of courses:

- MA3201 Rings and modules
- MA3202 Galois theory
- TMA4145 Linear Methods
- TMA4225 Foundations of Analysis
- TMA4190 Manifolds
- MA3402 Analysis on Manifolds
- TMA4195 Mathematical Modelling
- TMA4212 Numerical Solution of Differential Equations by Difference Methods
- TMA 4295 Statistical Inference
- TMA4300 Computer Intensive Statistical Methods

The workload of the programme will usually be distributed as follows:

Year	Sem-ester				
2	4 spring	Thesis			
	3 fall	Thesis		Elective course	Elective course
1	2 spring	Experts in team	Elective course	Elective course	Elective course
	1 fall	Elective course	Elective course	Elective course	Elective course
Credits/course		7,5 ECTS	7,5 ECTS	7,5 ECTS	7,5 ECTS

Depending upon the chosen specialization, the elective courses in the table, have to satisfy guidelines for mandatory courses (see list for each specialization). Note that in some cases it may be advisable to start work on the thesis already in the second semester, in order to make room for a course that only can be taken during the third semester of the program.

SPECIALIZATIONS

Algebra

Within the field of algebra, there are two available specializations, Algebraic Structures and Applied Algebra. The courses MA3201 Rings and Modules and MA3202 Galois Theory are mandatory for both specializations.

For specializations in algebraic structures it is also mandatory to take the course MA3203 Ring Theory and at least one other course in algebra, it is recommended that the fourth course is MA3204 Homological Algebra.

For specialization in applied algebra it is mandatory to take courses TMA 4185 Coding Theory and TMA4160 Cryptography. It is an advantage to have a background in informatics when choosing this specialization.

Analysis

In the field of analysis there are three fields of specializations available: Differential Equations, Functional Analysis and Complex/Harmonic Analysis. Within all these three it is also possible to work with either applied problems for a master's degree, or problems in pure mathematics. The courses TMA4145 Linear Methods and TMA4225 Foundations of Analysis are both mandatory for all three specializations, it is to the students advantage to do the course TMA4145 already in the Bachelor program.

Specialization in differential equations also requires the course TMA4305 Partial Differential Equations to be taken, and at least one more course in analysis. It is recommended for the student to choose at least one of the following three courses: TMA4195 Mathematical Modelling, MA8103 Non-linear Partial Differential Equations or TMA4170 Fourier Analysis.

To specialize in the field of functional analysis it is mandatory to take the course TMA4230 Functional Analysis, and at least one more course in analysis.

For the third specialization, Complex/Harmonic Analysis it is mandatory to take TMA4175 Complex Analysis and at least one more course in analysis. It is recommended to take one of the three following courses: TMA4170 Fourier Analysis, TMA4195 Mathematical Modelling and MA3105 Advanced Real Analysis.

Topology

Within topology it is possible to specialize in topology or geometry. Both applied and pure problems are possibilities for students working on their Master's thesis.

For both specializations mandatory courses are TMA4190 Manifolds, MA3402 Analysis on Manifolds and MA3403 Algebraic topology. It is also recommended to choose either MA3405 Algebraic Topology 2 or MA8402 Lie Groups and Lie Algebras, depending on specialization.

The courses MA3002 General Topology and TMA4165 Differential Equations and Dynamical Systems should be taken during the Bachelor degree.

Applied mathematics

Mandatory courses for this specialization are TMA4145Linear Methods and TMA4212 Numerical Solution of Differential Equations by Difference Methods. In addition to these, the student is advised to also choose at least three of the following courses: TMA4165 Differential Equations and Dynamical Systems, TMA4180 Optimization Theory, TMA4195 Mathematical Modelling, TMA4220 Numerical Solution of Partial Differential Equations Using Element Methods, TMA4205 Numerical Linear Algebra and TMA4305 Partial Differential Equations.

It is to the students advantage if the courses TMA4145 and TMA4212 are taken during the Bachelor degree.

Statistics

The courses TMA4295 Statistical Inference and TMA4300 Computer Intensive Statistical Methods are mandatory for the master’s programme in statistics. These courses can also be taken as part of the bachelor degree, in order to facilitate a gradual transition into higher level courses. In order to attain a master’s degree in statistics, the student must have done courses of at least 82,5 ECTS in statistics, of which the courses done in the bachelor degree are also included. Other courses relevant to the study of statistics may also be included if preapproved for this purpose.

EXAMINATION REGULATIONS AT THE NORWEGIAN UNIVERSITY OF SCIENCE AND TECHNOLOGY (NTNU)

Adopted by the Board of NTNU on 7 December 2005 in accordance with the Act of 1 April 2005 relating to Universities and University Colleges, subsections 3-3, 3-4, 3-5, 3-9, 3-10 and 5-3. Changed by regulations 24 January 2006 no. 120, 12 October 2006 no. 1156, 22 May 2008 no. 504, 14 September 2010 no. 1587, 30 March 2011 no. 372, 12 October 2011 no. 1047, and on 13 June 2012 no 679

Chapter 1 Scope, Purpose and Definitions

§1 Scope and Purpose

1. The regulations are valid for all studies at the Norwegian University of Science and Technology (NTNU).

2. The regulations contain rules about the organization of studies, examinations and assessment, requirements for the award of degrees, and regulations concerning the rights and obligations of the University and students at NTNU. The regulations are to ensure that studies and examinations at NTNU are carried out properly

§2 Definitions

Final examination	A type of assessment that normally follows at the end of the semester under conditions that can be controlled. The final examination generally is the concluding assessment of the student in a course or a group of courses.
Course	The smallest unit in which the student can receive an assessment and course grade. The extent of the course is measured in credits. The course involves activities that form the basis for assessment. The activities may be compulsory.
Subject	A collection of courses in one group in a curriculum.
Main profile	Courses in a curriculum which are defined as belonging to the same discipline which can supplement each other and build on foundation course level in a programme of study. In case a Master's degree is based on a completed Bachelor's degree, the main profile contains the academic qualifications required for admission to the Master's degree.
Final grade	The grade given after a course or group of courses. It is based on the assessments that count during that course. The weighting of the grades in assessments during the course is stated in the course description.
Credits	Measure of the study workload. The normal workload in one academic year is 60 credits.
Programme of study	A group of courses that forms one academic entity that students can apply for admission to, receive the right to study, and leads to a degree.
Field of study	A specialization within a programme of study, which is described in the curriculum for that programme of study.
Assessment	The evaluations a student receives on the basis of his/her performance in a course, or a group of courses and that lead to a grade.

One-year programme A structured group of courses totalling 60 credits and having separate admission.

These regulations refer to the Act relating to Universities and University Colleges of 1 April 2005, no. 15.

Chapter 2 Admission and individual education plan

§3 Admission

The valid admission regulations are the relevant regulations adopted by the Ministry of Education and Research and NTNU's own admission regulations.

§4 Admission to study and progress in studies

1. Admission involves the right to take the courses in the programme of study, a one-year programme or separate courses which the student has gained admission to. Admission provides the opportunity to take the courses specified in the individual education plan or in accordance with the progress in studies approved by the Faculty. Admission to study is valid from the day NTNU receives confirmation of the student's acceptance of his/her admission.
2. The right to take the programme of study which the student has been admitted to ceases when
   - the student fulfils the criteria allowing him/her to receive a certificate after completing the programme of study
   - the student has completed the one-year programme
   - the student's progress in studies is insufficient, according to the definition given in Section 4, subsection 3
   - the student himself/herself confirms that he/she has withdrawn from the programme of study before it is completed
   - the student has not paid the semester fee by the stipulated deadline, see Section 6.
3. In programmes of study that are divided into year courses/ years, a student cannot take the next year if he/she has an outstanding deficit of more than 22.5 credits from the two previous years. Students who want to take the 4th year cannot have any unfinished courses from the 1st year. Students who want to take the 5th year cannot have any unfinished courses from the 1st and 2nd years, and students who want to take the 6th year cannot have any unfinished courses from the 1st, 2nd, and 3rd years.
   The student loses the right to study a programme of study if he/she has an outstanding deficit of more than 22.5 credits. No student is permitted to use more than 2 academic years to take the same year in a programme of study. The time spent in each year should be adjusted according to any leave that has been granted, and any possible reductions in the study progress (part-time studies) that have been approved in the individual education plan, ref. Sections 5, 7, and 8.
   It is to be evident from the curriculum whether the programme of study is divided into years, ref. Section 14, subsection 1.
   Students that apply for re-admission to the same programme of study will, if applicable, be given recognition of previous studies in the year the student is admitted to. The same is true when there is great degree of similarity between a programme of study a student has applied for admission to and another programme of study a student has or had been admitted to. Exemption to this regulation can be made when more than three years have elapsed since the student was admitted to the other programme of study. Rector is to decide the matter.
4. The Faculty is to decide whether the right to study should be terminated in accordance with the above regulations. The Faculty may grant exemptions from the regulations in Section 4, subsection 3 in cases of illness, serious family problems, when the main part of the studies has already been completed, extraordinary conditions related to the subject (taking the next year) or other reasons found to warrant special treatment.
5. A student who is not covered the regulations in Section 4, subsection 3 has admission withdrawn if he/she has not earned any credits during one academic year in the programme of study or one-year programme that the student is admitted to. This does not apply if the student has registered for and been present at one or more examinations and when it is agreed in the

individual education plan that the student is not to earn any credits. The Faculty is to decide in matters of withdrawal of admission.

6. A student who has gained admission to a programme of study and has had normal progress (without adjustment for leave or reduced progress in studies), is not to be affected by changes in the disciplinary objectives, level and structure of the programme while completing his/her work on the programme. The student nevertheless has to accept that there may be changes in the courses and the structure of the programme of study that will not cause a delay in his/her progress.
7. A student who has gained admission to a programme of study, one-year programme or individual courses at NTNU, has the right to follow other courses he/she is qualified to take and receive assessment of his/her performance in these courses. The student also has the right to follow lectures in courses outside the programme of study or one-year programme if there are no restrictions on the admission to the courses. The student maintains these rights also after having completed the programme of study.

§5 Individual education plan

The Faculty together with students who have gained admission to study for 60 credits or more are to agree on an individual education plan before the end of the first semester. The individual education plan can be amended in agreement with the Faculty. The individual education plan is a mutual agreement between the student and NTNU concerning the duties and responsibilities of each party for progress in studies as well as the duties and responsibilities of each student towards his/her fellow students. The individual education plan gives the content and progress of the planned studies, cf. Section 6, subsection 2.

§6 Registration

1. Students who have been admitted to NTNU have to register and pay the semester fee at NTNU each semester by the deadline set by the Rector. The deadline is given in the curriculum and on NTNU's Internet pages. Students who do not pay the semester fee by the stipulated deadline will have their admission withdrawn in accordance with the regulations relating to Student Welfare Organizations of 12 February 2001, Section 10. The Faculty is to decide in matters of withdrawal of admission due to non-payment of the semester fee.
2. For students who have agreed to an individual education plan, this registration is to determine and confirm the information in the plan for the current semester concerning
   - which courses the student will attend
   - which courses the student is to be given assessment in
   - other possible activities determined in the programme of study which the student follows
   - other information where adjustments are possible and which is relevant for the student's progress in his/her studies.
3. Students who are not obliged to agree on an individual education plan or who have not yet entered into an individual education plan also have the duty to register. This registration is to indicate which courses the student will attend and receive assessment in.
4. The registration gives access to the resources offered by NTNU in order to enable the student to complete his/her courses that semester.

7 Leave of absence

1. The Faculty is to handle applications for leave of absence. Such leave from study is primarily given for one academic year. For shorter periods, leave can be given until the end on the semester. A student must have completed more than 30 credits in the courses included in the programme of study in order to apply for leave of absence without stating a reason.
2. The Faculty may accept an application for leave for more than one academic year if there are special circumstances or pressing reasons, such as illness, extensive demands for child-care etc., military service or civilian service.
3. The student must accept that there may be changes in the programme of study during a period when he/she has a leave of absence.

§8 Part-time studies
Studies at NTNU may be taken on a part-time basis following agreement with the Faculty. The percentage of the nominal progress in studies is to be included in the individual education plan.

§9 Students without the right to study
1. Those who have not been granted admission have the right to receive assessment in a course in accordance with the Act relating to Universities and University Colleges, Section 3-10. The Faculty decides whether the requirements for registration have been fulfilled and may specify further regulations concerning assessment in the absence of normal admission.
2. The Rector may decide upon a special deadline for registration for this type of assessment. The Rector can also decide that those who have not been admitted as students should pay an examination fee in order to cover the extra cost of carrying out such assessments.

§10 Teaching – delegation of authority in accordance with the Act relating to Universities and University Colleges, Section 3-8
1. The Faculty has the authority to reserve certain lectures just for the students of the University or specified groups of students if the nature of the lectures makes this necessary, cf. the Act relating to Universities and University Colleges Section 3-8, subsection 2.
2. The Faculty has the authority to allow people who are not following normal courses to attend lectures and participate in exercises whenever there is sufficient space.

§11 Suspension, exclusion – delegation of authority in accordance with the Act relating to Universitiesand University Colleges, Section 4-8, subsection 1
1. In cases where a student behaves in a way that seriously disturbs the work of fellow students or the general activities of the University, the Faculty has the authority to give a written warning stating that if such behaviour is continued a recommendation concerning suspension will be presented to the Board. In cases that are not specifically related to an individual Faculty, this authority rests with the Rector.
2. The Faculty has the authority to give a written warning to a student that an exclusion recommendation will be presented to the Board unless the suspension decision made by the Board is respected. In cases that are not specifically related to an individual Faculty, this authority rests with the Rector.
3. Complaints about decisions involving a written warning should be sent to the Appeals Committee at NTNU.

Chapter 3 Organization of studies

§12 The academic year
1. The academic year consists of 40 weeks and is divided into two semesters. The autumn semester extends over 19 weeks and finishes before the end of the year. The spring semester lasts 21 weeks.
2. The Board of NTNU may approve that a programme of study at NTNU deviates from the ordinary structure described in Section12, subsection 1 if the duration of the programme is more than 40 weeks and has teaching and/or studies which can be pursued independently of the other studies at NTNU.

§13 Programmes of study
1. Programmes of study at NTNU are organized according to the following models, they can
   - lead to a Bachelor's degree which subsequently forms the basis for a Master's degree.
   - be an integrated study which leads to a Master's degree or a professional degree
   - lead to a Master's degree which is based on a completed Bachelor's degree or equivalent education.

The Board establishes and terminates each programme of study at NTNU. When the Board creates a new programme of study, it should simultaneously decide which Faculty is to administer the programme.

2. Each programme of study has a main profile, which gives disciplinary specialization of at least 80 credits. All programmes of study involving 5-year integrated Master's degrees should also satisfy the requirements of the Bachelor's degree.
3. Each programme of studies consists of different courses. The courses offered should each be of 7.5 credits or a multiple of that. The courses given in the programme of study are either compulsory or optional. The Faculty establishes new courses and terminates old ones. For the Master of Science in Engineering programmes, the Rector has this authority. For courses in the 5-Year Teacher Education programmes, the Faculty exercises this authority in consultation with Rector. The Board at NTNU is to approve the establishment of courses where it is assumed that this will increase the basic disbursement in the State appropriation model.
4. All programmes of study leading to a lower degree as well as integrated programmes of study leading to a higher degree or a professional degree are to contain three introductory courses:
   a) Ex. phil. of 7.5 credits. 2/3 of the Ex. phil. is to be common for all students at NTNU. Ex. phil. should be suited to the disciplinary area but the variations are up to 1/3 of the content. The curriculum is to indicate the specific variety.
   b) Ex. fac. of 7.5 credits is specific for the relevant Faculty. It should be part of the main profile is and is to be taken in the first year.
   c) Perspective course of 7.5 credits that is to represent a different field of study from that included in the student's programme of study.
   Rector is to decide the detailed regulations for the introductory courses considering the recommendations from the Education Committee.

§13a One-year programmes

The Rector is to establish and terminate each one-year programme at NTNU following a recommendation from the Education Committee. The rector is also to decide which Faculty is to administer each one-year programme.

§14 Curriculum and course description

Each programme of study is to be described in a curriculum. The Faculty administering the programme of study is to approve the curriculum. Rector is to approve the curricula for the Master of Science in Engineering programmes and the 5-Year Teacher Education programmes.
The curriculum should contain information about possible admission requirements and ranking regulations for the programme of study. The curriculum should stipulate:

- the learning outcomes and professional objectives of the programme of study
- any required previous knowledge for the programme of study
- which Faculty is to administer the programme of study
- which courses are included in the programme of study
- the scope of the programme of study in terms of credits
- what course combination meets the required main profile
- the structure of the programme of study, whether the programme of study has been divided into years, the fields of study, which are the common courses, which are compulsory and optional courses, and the sequence of the courses
- the possibilities for student exchanges abroad
- other issues which affect the implementation and quality assurance
- transitional arrangements as a result of changes in the curriculum.

All courses are to be presented in a course description. Each Faculty is to provide a description of its own subject areas. Each course description should include:

- learning outcomes
- the qualifications necessary to gain admission to the course
- the content of the course
- teaching methods

- how many credits the course is worth
- the extent of the education
- possible compulsory education
- which activities are included, their extent and which of them are compulsory, for instance courses in methodology, exercises, work experience, field courses, excursions, laboratory work, group exercises, semester papers and other written exercises, artistic performances
- the requirements for receiving assessment
- activities that will be subject to on-going assessment and which of them will count in the course grade
- the organization of a possible final examination (how often, when in the semester, date and similar information)
- what examination support material can be used
- the form of assessment and grading scale for the assessments during the course
- the weighting of assessments during the course that are to count in the course grade

§15 Recognition of external studies/practical experience

1. The Faculty is to handle applications concerning recognition of external studies or practical experience in accordance with the Act relating to Universities and University Colleges, Section 3-5. A condition is that the external education has been approved as education at university or university college level.
2. The Faculty is to handle applications concerning the approval of an equivalent degree or education in accordance with the Act relating to Universities and University Colleges, Section 3-5.

§16 Exemption from assessment

1. The Faculty is to grant exemption from the final examination, test or other assessment in cases where the student can document that similar assessment has already been done by NTNU or another institution. The Faculty may also grant exemption on basis of other recognized examinations, tests or other kinds of assessment, or on basis of documented practical experience, in accordance with the Act relating to Universities and University Colleges, Section 3-5. When processing such applications for exemption, the Faculty should take both a student's previous education into account, as well as the assessment in terms of level, scope and content.
2. The student is to send such an application to the Faculty that administers the programme of study in which he/she has the right to study.

§17 Reduction of credits

If a student receives assessment in courses where the content wholly or partially overlaps, the total of credits for these courses should be reduced accordingly. The Faculty decides the extent of the reduction in each separate case. If some of the courses to which the student has gained admission to are compulsory, the reduction should take place in the optional courses. The reduction should be done in a way that provides the student with the best grade that has been awarded. The basis for the reduction should be evident from the transcript or certificate.

Chapter 4 Degrees

§18 Awarding degrees

The Faculties award degrees with their respective titles in accordance with their delegated responsibility from the Board when the latter approves a new programme of studies.

§19 Bachelor's degree

1. The Faculty awards the Bachelor's degree on basis of a completed programme of study or a free selection of courses in cases where the student has completed a total of 180 credits. The 180 credits should include:
   - a main profile of at least 80 credits, where the curriculum defines the requirements of the main profile
   - introductory courses of 22.5 credits, ref. Section 13, subsection 4.
2. If the Bachelor's degree is not based on an established programme of study, the Faculty that awards the degree is to cover the area where the major part of the disciplinary content belongs. If the student has a degree where more than one major parts are is included, the student can decide which of the relevant faculties should award the degree.

§20 Master's degree

1. In order to gain admission to a Master's programme which is based on a lower degree, the student must
   - have been awarded a Bachelor's degree or its equivalent
   - have received a passing degree in courses corresponding to 80 credits in the subject area of the relevant Master's degree, as specified in the curriculum for the relevant Master's programme
   - have fulfilled the other requirements for admission, as specified in the curriculum for the Master's programme.

   When admission to a Master's programme is based on experience, the second point is not valid.
   Instead, at least 2 years of relevant professional experience is demanded.
2. In order to receive a Master's degree, the student must
   - either satisfy the admission criteria of the Master's programme and in addition have passes in relevant studies corresponding to 120 credits, where the curriculum allows 30 credits to be replaced by relevant practical experience
   - or have completed a course of studies corresponding to 300 credits, where the requirements of the Bachelor's degree are included.
3. In the Master's programme described in Section 20, subsection 2, a Master's thesis corresponding to at least 30 credits, but no more than 60 credits, should be included.
4. In order to receive a Master's degree corresponding to less than 90 credits, the specified requirements relevant for such a degree programme must have been met.

§21 Candidata/candidatus medicinae

In a programme of studies leading to the degree candidata/candidatus medicinae, introductory courses as defined in Section 13, subsection 4 are included. The degree is based on a coherent course of study corresponding to 360 credits. The Faculty of Medicine will decide the content of the programme of study as well as additional criteria for awarding the degree.

§22 Candidata/candidatus psychologiae

In a programme of studies leading to the degree candidata/candidatus psychologiae, introductory courses as defined in Section 13, subsection 4 are included. The degree is based on a coherent professional study corresponding to 360 credits. The Faculty of Social Sciences and Technology Management will decide the content of the programme of study as well as additional criteria for awarding the degree.

Chapter 5 Assessment

§23 Assessment

1. In all courses or groups of courses included in a programme of study, the possibility for assessment and subsequent grading of the knowledge and skills of the students should be available each academic year. The assessment should be given as a final evaluation, or

possibly an evaluation based on different types of on-going assessments described in the curriculum.

2. In order to receive assessment, the student must have registered that same semester, and also meet the academic requirements for assessment given in the course description.
3. A student who has handed in a paper in an assessment cannot prevent the assessment from being done. The student cannot block an assessment if the examination began with an oral test.

§24 Examination periods

Final examinations take place at the end of each semester. The Rector decides the time of the examination periods. The dates are given in the curriculum. The Rector may decide to organize the examinations outside the regular examination periods, if practical considerations related to the courses or other things make this necessary.

§25 Final examination

The course description states whether the course is to be concluded with a final examination and what requirements the student has to satisfy in order to sit the final examination. A grade is always awarded at the final examination.

§26 Instructions at final examination

The Rector can issue general instructions for
- students who are allowed to sit a final examination
- invigilators
- the presence of teaching staff during a written final examination.

These instructions are found in the curriculum.

§27 Legitimate leave of absence at final examination

1. If a student is unable to sit a final examination due to illness or other pressing reasons, an application for approved absence has to be submitted to the Division of Student and Academic Affairs. The application, which has to be submitted at the latest one week after the first final examination to which the absence applies, has to contain information about which final examinations the application concerns. Documentation should be included in the application. The period of absence is to be indicated on the medical certificate.
2. A student who is taken ill during a final examination should notify the principal invigilator in the examination hall or the external examiner/internal examiner at oral examinations. The student subsequently has to see a doctor quickly and submit a medical certificate, as stated in the regulations in Section 27, subsection 1.

§28 Re-sit examination

1. In a course where the final examination is to be held only once in the academic year, a re-sit examination is to be arranged before the next normal examination. Students with an approved absence may take the re-sit examination. This also applies to students who have not passed the initial examination.
2. Students must register for the re-sit examination within the deadline stated by the Faculty or in the supplementary regulations.
3. The Faculty can in agreement with the Rector decide to organize the re-sit examination during the same period as the normal examination, in the next examination period or at a later time outside the examination period. For certain programmes of study, the time of the re-sit examination will be a standard arrangement that can be stated in the supplementary regulations.
4. During a re-sit examination, the quality of the assessment should correspond to the one given at the normal final examination. Alternative forms of assessment at re-sit examination should be stated in the course description.

§29 Approved absence from other types of assessment than final examination

The Faculty should, if practically possible, ensure that students with approved absence from other types of assessment than in the final examination can be assessed during the semester and before any possible final examination in the course.

§30 Re-examination

1. A student who has failed to pass the examination in a course has the right to repeat the examination and receive a new assessment. The course description or the supplementary regulations determine what areas have to be repeated after a student has failed to pass an examination.
2. The student has the right to complete a second period of practical work experience if he/she failed to pass the first period of practical work experience.
3. If the student has passed, he/she only has the right to re-take an examination once more in each course in order to improve his/her grade. If the student is registered for an examination and has not withdrawn his/her examination registration by the deadline decided by the Director of the Student and Academic Division, this is regarded as one attempt. The highest grade obtained is the one that counts. When the grade for a course is based on two or more assessments or tests, all of these have to be re-taken.

§31 New assessment of Master's thesis

A student may submit a new or revised Master's thesis once in cases where the thesis has not been awarded a passing grade. If the thesis has been given a passing grade, there is no opportunity for a new assessment in the same programme of study.

§32 Syllabus at new assessment/re-sit examinations

In case of new assessment and re-sit examinations, the syllabus of the course at the time of the new assessment or the re-sit examination is to be valid. In cases of changes in the national framework plans, the Ministry may decide upon special arrangements. If there are significant changes in the syllabus, there is to be a possibility to be assessed according to the former syllabus for at least one year, but no more than two years after the introduction of the changes.

§33 Adjusted forms of assessment

1. In order to give all students approximately the same working conditions when receiving assessment, students with particular requirements that have been sufficiently documented may apply for an adjusted form of assessment. Such an assessment does not imply any reduction in the general degree requirements.
2. The adjusted forms of assessment may be practically oriented in order to allow the use of special aids or extended time. In particular cases, types of assessment that differ from the normal one may also be accepted.
3. If the requirements of the student are permanent, the use of special aids may be allowed throughout his/her studies.
4. An application, including documentation, should be sent to the Division of Student and Academic Affairs before the registration deadline. The application is to be decided by the Rector. Applications for different forms of assessment from the one given in the course description are to be decided by the Rector in consultation with the Faculty.
5. Students with sudden acute requirements should as far as possible be given the same rights with regard to assessment as described above. An application containing sufficient documentation should be sent to the Division of Student and Academic Affairs as soon as possible after the acute situation has arisen.

§34 Form of language/language by written assessment

1. Arrangements with regard to the form of language used in examination papers are given in

Regulations concerning forms of language in examination papers of 7 July 1987. The regulations are in accordance with the Act of 11 April 1980 no. 5 concerning the use of Forms of Language in the Public Services.

2. Examination papers written in Norwegian should contain a version in the other form of the Norwegian language (*bokmål* and *nynorsk*). The exception is examination papers in the subject Norwegian. In case all the students prefer the same form of language, the examination papers may only be written in this form. The students choose their form of language as they register for an examination.
3. If the lectures are given in a non-Scandinavian language, the examination paper should also include a version in the language that has been used in the lectures. Applications requesting the examination paper to be in a language different from Norwegian or that used in teaching are to be decided by the Faculty.
4. In examinations at higher degree level, the Faculty may decide that the text in the examination paper is in a non-Scandinavian language even though there is no requirement that the examination answer paper is to be written in that language. Higher degree level means master's programmes or the 4th, 5th or 6th years in integrated programmes of study. The decision concerning this is to be indicated in the course description.
5. If a significant portion of the curriculum of the course is written in a language that is different from the one used in lectures, the Faculty may decide that the examination paper should contain a version in this language as well.
6. Assessment papers and Master's theses can be written in Norwegian, Danish, Swedish or English unless stipulated otherwise in the course description or in description of the programme of study.
7. If another foreign language than English is part of the characteristics of the course, its learning objectives or curriculum, the Faculty is to determine which language the candidate is to use in his/her assessment paper.
8. The Master's thesis is to be written in the language that is most relevant to the content of the topic and the practical conditions of each individual master's student. The Faculty is to determine which languages can be approved within this framework. Master's theses that are written in Norwegian are to have a summary in English or another relevant language. Master's theses written in a non-Scandinavian language are to have a short summary in Norwegian. The Faculty may waive this provision if the candidate is an international student and does not speak one of the Scandinavian languages (Norwegian, Swedish or Danish).

§35 Oral examinations behind closed doors

At the request of the student, the Faculty may decide against making an oral examination public in cases where there are pressing reasons, ref. the Act relating to Universities and University Colleges, Section 3-9, subsection 3. The Faculty should ensure that the assessment in these cases also satisfies the normal academic level in the programme of study.

§36 Academic misconduct or an examination offence/attempted academic misconduct or an examination offence

1. In cases of academic misconduct or an examination offence/attempted academic misconduct or an examination offence, the University Appeals Committee may cancel the assessment in accordance with the Act relating to Universities and University Colleges, Section 4-7. The same applies to the recognition of courses, credits or education, as well as exemption from assessment.
2. In accordance with the Act relating to Universities and University Colleges, Section 4-8, subsection 3, the University Appeals Committee may expel a student who has behaved contrary to the regulations for up to one year. The student may also lose his/her right to sit for examinations within institutions affected by the ruling for up to one year.
3. More detailed information about reactions to academic misconduct or an examination offence is given in Guidelines for reactions to academic misconduct or examination offences/attempts at academic misconduct or examination offences at NTNU of 30 May 2001.

Chapter 6 Determination of grades

§37 Examiners

1. The Faculty appoints the examiners, ref. the Act relating to Universities and University Colleges, Section 3-9, subsection 2. For inter-faculty courses such as "Experts in Team" that are not administered by one faculty, the rector is to appoint the external examiner(s). If there is an appeal, the Faculty is to appoint the external examiner(s). The examiners are appointed for 3 years at a time.
2. At least two examiners are to be present at oral examinations and assessment of vocational training or other activities of a type that cannot be subsequently checked. At least two examiners, of whom at least one should be external, should be present at the assessment of Master's theses, ref. the Act relating to Universities and University Colleges, Section 3-9, subsection 2.
3. The Faculty determines the guidelines regarding external participation at the assessment, whether general or a specific programme of study. This could be done by external participation in each separate assessment or through an external evaluation of the assessment procedures.

§38 Deadlines for determination of grades

In accordance with the Act relating to Universities and University Colleges, Section 3-9, subsection 4, the deadline for determination of grades is 3 weeks following the examination, unless special reasons make it necessary to use more time. When special reasons occur, a new deadline should be announced. The deadline for assessment of the Master's thesis is 3 months after the thesis has been handed in.

Chapter 7 Grades

§39 Grading scales

Assessment is given on basis of grading, either through a scale ranging from A to F or on the basis of Passed/Not Passed. Grade A is the highest pass grade, while Grade E is the lowest pass grade. The grading scale is based on the following descriptions and general qualitative descriptions:
symbol description General, qualitative description of valuation criteria

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

Passed/Not Passed is used where assessment is not required.
The Faculty is to provide descriptions of the assessment criteria that are specific for each subject.

§40 Grade Point Average

The Grade Point Average can be estimated as long as letter grades have been given for at least 75% of the credits. When estimating the Grade Point Average, all grades in each separate course should be included.

The Grade Point Average is determined as follows:

1. Each letter grade is replaced by its equivalent number, A=5, B=4, C=3, D=2, E=1.
2. The numerical equivalent is multiplied by the number of credits in the course, and the separate sums of credits and numerical equivalents are added up for all courses that are included.
3. This total is subsequently divided by the total number of credits included in all the courses.
4. The quotient is calculated to one decimal place.
5. The Grade Point Average is the letter degree which represents the equivalent of the full number of the quotient after the normal rounding-up rule has been applied.

§41 Final grade

1. Whether or not a final grade is to be given is decided by supplementary regulations.
2. The final grade means the overall grade for the entire programme of study at the award of degree. The grade is a weighted average based on the letter grades in the courses included in the degree. In order to get a final grade the student must have a pass mark in courses at NTNU corresponding to at least 120 credits, and at least 75% of these must have been given a letter grade. The method for calculating the final grade is the same as that described for the Grade Point Average in Section 40.

§42 Explanations and appeals

1. Cases involving the explanation of grades and complaints about them are to be handled in accordance with the Act relating to Universities and University Colleges, Section 5-3. Requests for an explanation of grades and complaints should be forwarded to the Faculty. Guidelines for examiners are to be issued in connection with each examination question paper. These quidelines are to be available for students after the examination grade is decided.
2. If there is a new assessment of a grade, at least two new examiners, including at least one external, are to be involved, ref. the Act relating to Universities and University Colleges, Section 3-9, subsection 5. The new examiners should not have any information about the initial grade, the explanation for it or the basis of the student's complaint.
   If the examiner(s) in the first assessment find passages that are copied without citing the sources, but situation is not considered serious enough to be termed academic misconduct, the department may be notified by the examiner(s). If the student lodges a complaint about the grade he/she has received, the department is allowed to inform the new examiners about the lack of source citation. The department is to inform the student that the new examiners will be informed about the lack of source citation.
3. When on-going assessment is used, the student cannot lodge a complaint until he/she has received the grade in the relevant course or group of courses. Although the student cannot lodge a complaint following each separate assessment, he/she has the right to an explanation of the grading for each separate assessment.
4. Complaints against procedural errors can be submitted in accordance with the Act relating to Universities and University Colleges, Section 5-2. The complaint is to be sent to the Faculty. In accordance with Section 5-2 of the Act relating to Universities and University Colleges, complaints can only be made about on-going assessments which will be included in the certificate or that count as part of the final grade.
5. Complaints about the grading of group work, where a common grade is given, all participating students must agree and sign the complaint. The same applies to complaints about procedural errors in these cases.

Chapter 8 Certificates and transcripts

§43 Certificates

1. Certificates are issued after the completion of a degree or an educational programme. A certificate is normally issued only once for the same degree/education. The certificate is to contain information about the programme of study the degree is based on. The certificate should show the semester and year the degree/educational programme was completed. The final grade (if applicable) is to be given on the certificate. Diploma supplements form a part of the certificate. A transcript of grades showing the courses the student has passed should be attached to the certificate.
2. In order to receive a certificate for a completed degree at NTNU, at least 60 of the credits to be included in the basis of calculation of the degree have to been taken at NTNU.
3. For the degrees that are awarded in cooperation with other Norwegian or foreign institutions (joint degrees) at least 30 credits have to be be taken at NTNU.
4. When recognition is given for education that has previously been used in the basis of calculation of a degree or as part of a degree or professional training, a student must also have completed at least 60 new credits before he/she can be awarded a new degree. The Faculty may decide requirements for up to 90 new credits for certain programmes. Rector has the authority to adopt requirements for up to 90 new credits for the Master of Science in Engineering programmes and the 5-Year Teacher Education programmes.

§44 Transcript

Upon request, students are to receive a transcript confirming their passing grades. The transcript should show the grades given in each course, the year and semester in which the grades were obtained, as well as the title and number of credits for the courses.

Chapter 9 Supplementary regulations and implementation

§45 Supplementary regulations

The Faculty has the authority to add supplementary regulations to these regulations. For inter-Faculty programmes of study, the supplementary regulations are to be accepted by all faculties involved. For the Master of Science in Engineering programmes and the 5-Year Teacher Education programmes, Rector has the authority to add supplementary regulations.

§46 Implementation

The regulations are to come into force immediately.

EXTRACTS FROM ACT OF 1 APRIL 2005 RELATING TO UNIVERSITIES AND UNIVERSITY COLLEGES

Chapter 3 Academic decisions - accreditation

§ 3-9. Examinations and marking

1. Universities and university colleges shall ensure that students' knowledge and skills are tested and assessed in a manner that is impartial and academically sound. Assessment shall also safeguard the academic standards of the course of study in question. An external evaluation shall be made of the assessment or assessment arrangements.
2. The board shall appoint examiners for examinations, tests, assessments of assignments or other assessments the results of which are entered on the diploma or included in the mark given for the course of study in question. When assessing candidates' independent work in higher degree courses, each candidate shall be assessed by at least two examiners, of whom at least one shall be external.
3. The oral parts of examinations and tests shall be public unless regard for the examination or test arrangements indicates otherwise. The board may make exceptions to the rule concerning public examinations in particular cases at the request of the examination candidate concerned when particularly weighty reasons so indicate.
4. Marks shall be made known within three weeks unless for special reasons more time is required. The board may itself make exceptions in respect of specific examinations and may in temporary regulations pursuant to the seventh paragraph set a longer time limit when it is not possible to provide the number of qualified examiners required to complete the marking within three weeks. The board may itself in a regulation pursuant to the seventh paragraph set a longer time limit for dissertations and similar large written works.
5. Re-marking pursuant to sections 5-2 and 5-3 shall be carried out by at least two new examiners, of whom at least one shall be external. Marks may be changed in the appellant's favour and disfavour. If the final mark is set on the basis of both a written and an oral test and an appeal against a mark for the written part of the examination is upheld, a new oral test shall be held to determine the final mark.
6. The mark awarded following an examination, test, assessment of an assignment or other assessment shall either be pass/fail or be based on a graded scale of six marks from A to F, where A to E indicate a pass and F indicates a fail.
7. The board itself issues regulations governing the taking and arrangement of examinations and tests, including the conditions for resitting an examination or test and for permission to retake a practice period, and provisions concerning registration and the conditions for registration for examinations. In the case of courses for which national curriculum regulations have been established pursuant to section 3-2, second paragraph, the regulations must be based on any general provisions concerning examinations and assessment contained in the curriculum regulations. The board may delegate the issue of supplementary provisions concerning special circumstances relating to particular examinations to a faculty or department.

Chapter 4 The students' rights and obligations

§ 4-7. Annulment of examinations or tests

1. The board itself or the board's appeals committee, cf. section 5-1, may annul an examination or test or recognition of a course if the student
   a) by using a false diploma or by other dishonest means, has gained admission to the examination or test or to attend the course concerned, or
   b) has attempted to cheat or wilfully or through gross negligence has cheated in the course of or prior to the final assessment of the examination or test concerned, or while taking the course in question.
2. The board itself or the institution's appeals committee, cf. section 5-1, may annul credit for or recognition of a course or exemption from an examination or test if the student obtained it by using a false diploma or by other dishonest means.
3. Annulment decisions pursuant to the first and second paragraph may be appealed to the Ministry or to a special appeals body appointed by the Ministry, cf. section 5-1, seventh paragraph.
4. The right to annulment has no time limit.
5. An annulment decision entails an obligation to return any diplomas or mark transcripts to the institution. If such diploma or mark transcript is not returned to the institution at the proper time, the institution may obtain the assistance of an enforcement officer (namsmann) to secure its return, pursuant to the provisions laid down in Chapter 13 of the Enforcement Act.
6. If the diploma can form the basis of authorization for the exercise of a profession or trade, the institution shall notify the authority concerned of the annulment.

7. Other institutions under the present Act may be informed of the annulment of an examination or test. The Ministry issues specific provisions concerning information routines, etc.

§ 4-8. Exclusion

1. A student who despite written warning by the board repeatedly behaves in a manner which seriously disturbs the work of fellow students or other activities at the institution may be excluded by the board itself or the institution's appeals committee, cf. section 5-1, from specific parts of the institution for up to one year. If a student after receiving a written warning from the board continues not to respect such exclusion, the board itself or the institution's appeals committee, cf. section 5-1, may exclude him or her from attending courses for up to one year.
2. A student who has behaved in such a seriously censurable manner as to endanger the life or health of patients, clients, children attending a day care institution, pupils or others with whom the student comes into contact in connection with clinical or practical training or who in relation to such persons commits serious breaches of the obligation to observe secrecy or behaves with gross indecency, may, if the board itself or the institution's appeals committee, cf. section 5-1, so decides, be excluded from attending courses for up to three years. The institution shall inform the Norwegian Directorate for Health and Social Welfare of any exclusion pursuant to this provision of students attending courses that may result in a right of authorization pursuant to section 48, first paragraph, of the Health Personnel Act.
3. A student who has behaved as described in section 4-7, first or second paragraph, if the board itself or the institution's appeals committee so decides, cf. section 5-1, may be excluded from the institution and deprived of the right to sit examinations at institutions under this Act for up to one year. The Ministry issues specific provisions concerning information routines, etc.
4. A decision to exclude a student requires a majority of at least two-thirds. The student may appeal against such a decision pursuant to the provisions laid down in the Public Administration Act. The Ministry or a special appeals body appointed by the Ministry is the appeals body.
5. The student is entitled to seek the assistance of a lawyer or other spokesman from the date the question of exclusion is raised or from the date of any written warning pursuant to the first paragraph. The cost of such assistance shall be met by the institution.

Chapter 5 Appeals

§ 5-2. Complaints against procedural errors in connection with examinations

1. A candidate who has taken an examination or test may complain of procedural errors within three weeks of the date when he or she became or should have become aware of the circumstance on which the complaint is based. Such complaints are ruled on by the board itself or the institution's appeals committee. 1 April 2005
2. If an error was committed which may have affected the student's performance or its assessment, the mark shall be rescinded. If the error can be corrected by remarking the papers submitted, they shall be re-marked. Otherwise a new examination or test shall be held with new examiners. The mark awarded in a second assessment pursuant to the present section may be appealed against pursuant to the provisions laid down in section 5-3.
3. If a request for explanation of or an appeal against a mark has been submitted, the time limit for an appeal pursuant to this section is reckoned from the date when the student receives the explanation or when the appeal is finally ruled on.
4. If the board or the board's appeals committee finds that formal errors were committed and that this can reasonably be supposed to have affected the performance of one or more candidates or the assessment of that performance, the decision may be taken to carry out a new assessment or to hold a new examination or test.

§ 5-3. Complaints regarding marks awarded - right to explanation

1. A student is entitled to an explanation of the marks awarded for his or her performance. At oral examinations or assessments of practical skills, a request for such an explanation must be made immediately on notification of the mark. Requests for explanations of other assessments must be submitted within one week after the candidate learns of the mark, but never more than three weeks after the announcement of the mark.
2. Explanations shall normally be given within two weeks after the candidate requests them. They shall state the general principles on which the assessment was based and explain the assessment of the candidate's performance. Explanations may be given orally or in writing at the examiner's discretion.
3. If written guidelines for assessments have been issued, they shall be available to students after the marks have been decided.
4. A student may appeal in writing against a mark awarded for his or her performance within three weeks of the announcement of the examination results. The performance shall then be reassessed. In the event of a request for an explanation of a mark or a complaint of procedural errors in the question-setting, the examination procedure or the assessment procedure, the time limit for appeals pursuant to this section is reckoned from the date when the student receives the explanation or when the appeal is finally ruled on. In connection with the use of

continuous assessment, the institution may decide whether the student shall submit an appeal following the assessment of a separate examination, assignment or other assessment or whether an appeal shall be submitted on announcement of the result of assessment of the study programme, discipline, or module.

5. Appeals may not be lodged against marks awarded for oral performance and assessment of practical training or the like which, owing to the nature of the test cannot be reviewed. The results of preliminary examinations (forprøver) may only be appealed against when the examination is failed.
6. Marks awarded following re-marking pursuant to this section may not be appealed against.

INFORMATION ABOUT CHEATING AND ACADEMIC MISCONDUCT IN HOME EXAMINATIONS, SEMESTER ASSIGNMENTS AND OTHER EXAMINATIONS AT NTNU

On 12 October 2006, the Board of NTNU passed Guidelines concerning the action to be taken in cases of students cheating or attempting to cheat at examinations at NTNU. This extract from these Guidelines is written to give students important information about this matter.NTNU regards cheating as a serious matter with grave consequences when a student is even suspected of cheating. Failing to respect the work of others by not citing sources can lead to an examination being failed and even expulsion from NTNU and all higher education in Norway for up to one year.

NTNU defines cheating as actions that are in conflict with the examination regulations that lead to the results being more favourably judged than would otherwise be the case. This is a broad definition that includes gross negligence. The following examples clarify what NTNU can regard as cheating:

- An examination answer paper with all or some of the text from the Internet that is presented as the student's own work
- An examination answer paper with all or some of the text used by someone else at a previous examination
- An examination answer paper with all or some of the text used by the student at a previous examination
- An examination answer paper with all or some of the text written by someone else
- Work that is handed in as the student's own work that is written, designed or composed by someone else
- Quotes from textbooks, other sources, or the Internet that are not presented with their sources and are not clearly marked as quotations (plagiarism)
- Using examination support material that is not permitted

Ask your professors, Student Service or student advisers at NTNU if you are unsure about the rules relating to cheating. It is the student's own responsibility to find out about the rules relating to the use of other people's work - plagiarism - which is against Norwegian law (see below). In an examination, each student must find out what examination support material is permitted.

Plagiarism detection
NTNU has acquired a system for plagiarism detection. This system is designed to detect plagiarism in examination answer papers submitted in connection with teaching at NTNU. This means that texts submitted by students in courses at NTNU can be checked for plagiarism.

What Norwegian law says about cheating

The Act of 1 April 2005 relating to Universities and University Colleges Section 4-7, Subsection 1, b. states that the University Appeals Committee can annul an examination or test or approval of a course if the student has

attempted to cheat or on purpose or with gross negligence has cheated in the course of or prior to the final assessment of the examination or test concerned, or while taking the course in question.

Annulment of the examination (The above Law, Section 4-7, Subsection 1, b)
The least severe reaction is annulment of the examination. Annulment alone is used in the least serious cases of cheating. An attempt to cheat includes gross negligence. The matter is decided by the University Appeals Committee.

Suspension from further studies (The above Law, Section 4-8, Subsection 3)
In the graver cases of cheating the student may be excluded from NTNU and may lose the right to take examinations at other institutions covered by the Act relating to Universities and University Colleges for a period of one year. The matters is decided by the University Appeals Committee and requires two-thirds majority, see Act of 1 April 2005 relating to Universities and University Colleges Section 4-8, Sub-section 4.

NTNU's Examination Regulations can be found on http://www.ntnu.no/studier/reglement. See Examination Regulations at the Norwegian University of Science and Technology (NTNU) (pdf).