Chemistry MSc

VU University Amsterdam - Faculteit der Exacte Wetenschappen - M Chemistry - 2015-2016

This programme is offered jointly with the Universiteit van Amsterdam (UvA).

Specializations
During the Master's in Chemistry, students can specialize themselves by doing a Major in one of the following disciplines:

-Analytical Sciences
-Molecular Design, Synthesis and Catalysis
-Molecular Simulation and Photonics

Variants
The Master's programme of Chemistry offers three different variants for graduation:

-Research variant (O - variant)
-Society-oriented variant (M - variant)
-Communication-education variant (C / E - variant)

The global composition of each variant is indicated below:

Variant	**O**	**M**	**C**	**E**
Compulsory courses (Major)	24-42*	18	18	18
Research project (Major)	42	36	36	36
Literature study and colloquium	12	6	6	6
Ethics and Portfolio academic skills	6	-	-	-
M, C or E programme	-	60	60	60
Optional programme, e.g. - deficiency courses - research project extension - scholarship (company, abroad) - advanced courses	18-36*	-	-	-
Total cp	120	120	120	120

Ad *) Depends on the specialization : Molecular Simulation & Photonics requires 30-42 EC compulsory courses with 18-30 EC optional programme, other specializations require 24 EC compulsory courses with 36 EC optional programme.

Students should arrange the composition of their Master's programme in consult with the Master's coordinator. The exam committee formally has to approve the composition and extent of the Master's programme.

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Communication Variant

This specialization is intended for students with a BSc degree in any of the bèta-studies who want to specialize in communication. The programme focuses on science communication theory, research and practice. The programme of the communication (C) specialization is 1 year (60 credits). This specialization may not be combined with te Societal specialization (M) or the Education specialization (E). C-courses are shared with master students from the Faculty of Earth and Life Sciences.

Programme

For a specialization degree it is required to spend 60 credits on Science Communication components. Two courses, one internship and a thesis are compulsory. The rest of the programme can be filled with optional courses. While science communication research is always a component of a students' internship, students have the opportunity to choose for placement at institutes such as newspapers, museums, science centers, companies, etc. to hone their practical as well as academic skills. Students' thesis comprise short (9 credits) literature studies on research questions about aspects of science communication.

To complete his or her entire Master programme (120 credits), the student has to choose 60 credits Chemistry courses.
Before formal enrolment, the students' programme has to be approved by the master coordinator as well as the programme coordinator for the Science Communication.

Programme components:

- Optional Courses for Communication Variant
- Chemistry Courses for Communication Variant

Optional Courses for Communication Variant

Courses:

Name	Period	Credits	Code
Communication, Organization and Management	Period 2	6.0	AM_470572
Science in Dialogue	Period 2	6.0	AM_1002
Science Journalism	Period 2	6.0	AM_471014
Science Museology	Period 3	6.0	AM_470590

Chemistry Courses for Communication Variant

In addition to the courses below a total of at least 18 EC of track specific courses has to be chosen in consultation with the master coordinator.

Programme components:

- Internship communication

Courses:

Name	Period	Credits	Code
Colloquium and Literature Thesis	Ac. Year (September)	6.0	X_432578
Master Research Project Communication Variant	Ac. Year (September)	36.0	X_432586
Research methods for analyzing complex problems	Period 1	6.0	AM_1182
Science and Communication	Period 1	6.0	AM_470587

Internship communication

Courses:

Name	Period	Credits	Code
Reflective Practice Internship Science Communication	Ac. Year (September)	30.0	AM_1163
Research Internship Science Communication	Ac. Year (September)	30.0	AM_1162

Education Variant

The teaching in these variant is mainly in Dutch. Therefore we also give the requirements in Dutch.

Programma

De opleiding voor het behalen van de eerstegraads lesbevoegdheid start twee keer per jaar, in september en in februari. De opleiding wordt aangeboden in twee semesters. Uitgaande van de start in september duurt semester 1 tot en met januari en semester 2 tot juli. De opleiding is sterk praktijkgericht. De helft van de opleiding bestaat uit praktijk door werkervaring of stage (ook wel schoolpracticum genoemd) op een school voor voortgezet onderwijs. Daarnaast kent de opleiding vier componenten: vakdidactiek, algemene didactiek/pedagogiek, praktijkonderzoek en verdiepingsmodulen.

Naast de educatievakken volgt de student 60 sp Chemistry vakken, in overleg met de mastercoördinator van de gekozen specialisatie.
Hierbij zijn de twee vakken Literature thesis and Colloquium Chemistry Education Variant en Master Research Project Chemistry-Education Variant verplicht.

Studenten die bij de Communicatie variant de vakken 'interpersoonlijke communicatie' en 'museologie en buitenschoolse educatie' volgen, krijgen

bij de lerarenopleiding een vrijstelling voor verdiepingsmodulen, een deel van het praktijkonderzoek en een deel van algemene didactiek.

Programme components:

- Master Leraar VHO Scheikunde vanaf 2015
- Leraar voorbereidend hoger onderwijs in Scheikunde verplicht
- LVHO Scheikunde, overgangsregeling
- Chemistry Courses for Education Variant

Master Leraar VHO Scheikunde vanaf 2015

Courses:

Name	Period	Credits	Code
Didactiek 1	Period 1, Period 4	6.0	O_MLDIDAC_1
Didactiek 2	Period 2+3, Period 5+6	6.0	O_MLDIDAC_2
Didactiek 3	Period 4+5+6	9.0	O_MLDIDAC_3
Peergroup 1	Period 1+2+3, Period 4+5+6	0.0	O_MLPEERGR_1
Peergroup 2	Period 3+4+5	0.0	O_MLPEERGR_2
Praktijk 1	Period 1, Period 4	6.0	O_MLPRAK_1
Praktijk 2	Period 2+3, Period 5+6	9.0	O_MLPRAK_2
Praktijk 3	Period 4+5+6	15.0	O_MLPRAK_3
Praktijk onderzoek 1	Period 3, Period 6	3.0	O_MLPROZ_1
Praktijk onderzoek 2	Period 4+5+6	6.0	O_MLPROZ_2

Leraar voorbereidend hoger onderwijs in Scheikunde verplicht

Courses:

Name	Period	Credits	Code
Educational and Pedagogical Studies II	Period 1+2	3.0	O_MLADEPII
Research II	Period 1+2+3	6.0	O_MLVPOOII
Specialisation	Period 2+3	3.0	O_MLVERD
Teaching Methodology Chemistry II	Period 1+2	6.0	O_MLVDSKII
Teaching Practice II	Period 1+2+3	15.0	O_MLPRAKII

LVHO Scheikunde, overgangsregeling

Courses:

Name	Period	Credits	Code

Educational and Pedagogical Studies I	Period 1+2	6.0	O_MLADEPI
Research I	Period 1+2+3	3.0	O_MLVPOOI
Teaching Methodology Chemistry I	Period 1+2	3.0	O_MLVDSKI
Teaching Practice I	Period 1+2+3	15.0	O_MLPRAKI

Chemistry Courses for Education Variant

In addition to the courses below a total of at least 18 EC of track specific courses has to be chosen in consultation with the master coordinator.

Courses:

Name	Period	Credits	Code
Colloquium and Literature Thesis	Ac. Year (September)	6.0	X_432579
Master Research Project Education Variant	Ac. Year (September)	36.0	X_432587

Research Variant Analytical Sciences

The programme constists of 120 credits.

The research training takes place in one of the 4 research groups. Students must contact the Master coordinator at least two months before they would like to start their research training. The research training (Major) starts with a literature study and ends with a Master thesis, an oral presentation and a poster presentation. The research training (Minor) also starts with a literature study and ends with a written report and an oral presentation.

The program starts with an introductory course in which the basic concepts of analytical chemistry and the different areas where it is used, with their own specific problems, are discussed. Then separation techniques, spectroscopy and statistics will be taught at the master level. After these compulsory topics the program leaves a lot of freedom to go in detail into some of the advanced topics.

Research groups

The Master program Analytical Sciences is a unique combination of five strong analytical groups from the VU University Amsterdam (VU) and the University of Amsterdam (UvA). As these groups are complementary, a broad range of analytical topics is covered.

- Applied spectroscopy
- Bio-molecular Analysis
- Polymer analysis
- Biosystems Data Analysis
- Environmental analysis

Note: Every programme, including the choice of optional courses, has to

be discussed and agreed upon with the master coordinator or a personal mentor and approved by the Examination Board.

Master Coordinator:

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K room O-357
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Programme components:

- Compulsory Choice Ethics and Portfolio academic Skills
- Research Project
- Optional Courses
- Compulsory Courses

Compulsory Choice Ethics and Portfolio academic Skills

Students need to select a total of 6 credits from the following list.

Note: Every programme, including the choice of optional courses, has to be discussed and agreed upon with the master coordinator or a personal mentor and approved by the Examination Board.

Courses:

Name	Period	Credits	Code
English Academic Course	Period 2+3, Period 5+6	3.0	X_437028
Science in Perspective	Period 4+5	6.0	X_437030
Teaching Assistant	Ac. Year (September)	3.0	X_432741
Teaching Assistant	Ac. Year (September)	6.0	X_432742
Tutoring Students	Period 2	3.0	X_432625

Research Project

Compulsory choice of at least 42 credits. Optional extension of 6, 12 or 18 credits.

Note: Every programme, including the choice of optional courses, has to be discussed and agreed upon with the master coordinator or a personal mentor and approved by the Examination Board.

Courses:

Name	Period	Credits	Code
Master Research Project Biomol. Analysis and Spectr.	Ac. Year (September)	42.0	X_432594
Master Research Project Biomol. Analysis and Spectr. ext	Ac. Year (September)	18.0	X_432595

Master Research Project Biomol. Analysis and Spectr. ext	Ac. Year (September)	12.0	X_432637
Master Research Project Biomol. Analysis and Spectr. ext	Ac. Year (September)	6.0	X_432680

Optional Courses

The subject options of 36, 30, 24 or 18 credits can be completed with the possibilities below.

Courses:

Name	Period	Credits	Code
Advanced Separation Sciences	Period 3	6.0	X_432844
Advanced Spectroscopy	Period 6	6.0	X_432767
Advanced Statistics for Analytical Chemistry	Period 5	6.0	X_437589
Bio-analysis & Clinical Diagnostics	Period 1	6.0	X_432765
Biosystems Data Analysis	Period 3	6.0	X_437001
Chemical Analysis for Forensic Evidence	Period 2	6.0	X_437003
Environmental Chemistry	Period 1	6.0	X_437004
Environmental Measuring Techniques	Ac. Year (September)	6.0	AMU_0005
High-Throughput Screening	Period 2	6.0	X_435047
Internship Biomolecular Analysis and Spectroscopy	Ac. Year (September)	18.0	X_432523
Internship Biomolecular Analysis and Spectroscopy	Ac. Year (September)	24.0	X_432524
Internship Biomolecular Analysis and Spectroscopy	Ac. Year (September)	30.0	X_432525
Internship Organic Chemistry	Ac. Year (September)	18.0	X_432529
Internship Organic Chemistry	Ac. Year (September)	24.0	X_432530
Internship Organic Chemistry	Ac. Year (September)	30.0	X_432531
Internship Theoretical Chemistry	Ac. Year (September)	18.0	X_432532
Internship Theoretical Chemistry	Ac. Year (September)	24.0	X_432533
Internship Theoretical Chemistry	Ac. Year (September)	30.0	X_432534
Minor Research Project Biomol. Analysis and Spectr.	Ac. Year (September)	18.0	X_432649

Minor Research Project Biomol. Analysis and Spectr.	Ac. Year (September)	24.0	X_432650
Minor Research Project Biomol. Analysis and Spectr.	Ac. Year (September)	30.0	X_432651
Minor Research Project Organic Chemistry	Ac. Year (September)	18.0	X_432640
Minor Research Project Organic Chemistry	Ac. Year (September)	24.0	X_432641
Minor Research Project Organic Chemistry	Ac. Year (September)	30.0	X_432642
Minor Research Project Theoretical Chemistry	Ac. Year (September)	18.0	X_432646
Minor Research Project Theoretical Chemistry	Ac. Year (September)	24.0	X_432647
Minor Research Project Theoretical Chemistry	Ac. Year (September)	30.0	X_432648
Nuclear Magnetic Resonance	Period 4	6.0	X_435667
Protein Analysis	Period 5	6.0	X_435045
The analytical Chemist in Industry	Period 4	6.0	X_437005

Compulsory Courses

Courses:

Name	Period	Credits	Code
(Bio)Molecular Spectroscopy	Period 5	6.0	X_435062
Colloquium and Literature Thesis	Ac. Year (September)	12.0	X_432581
Fundamentals of Analytical Sciences	Period 4	6.0	X_435059
Mass Spectrometry	Period 2	6.0	X_435604
Separation Sciences	Period 1	6.0	X_435609

Research Variant Molecular Design, Synthesis and Catalysis

The programme consists of 120 credits.

Note: Every programme, including the choice of optional courses, has to be discussed and agreed upon with the master coordinator or a personal mentor and approved by the Examination Board.

Master Coordinator:

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Programme components:

- Compulsory Choice Ethics and Portfolio academic Skills
- Research Project
- Recommended optional Courses
- Optional Courses
- Compulsory Courses

Compulsory Choice Ethics and Portfolio academic Skills

Students need to select a total of 6 credits from the following list.

Note: Every programme, including the choice of optional courses, has to be discussed and agreed upon with the master coordinator or a personal mentor and approved by the Examination Board.

Courses:

Name	Period	Credits	Code
English Academic Course	Period 2+3, Period 5+6	3.0	X_437028
Science in Perspective	Period 4+5	6.0	X_437030
Teaching Assistant	Ac. Year (September)	3.0	X_432741
Teaching Assistant	Ac. Year (September)	6.0	X_432742
Tutoring Students	Period 2	3.0	X_432625

Research Project

Compulsory choice of at least 42 credits. Optional extension of 6, 12 or 18 credits.

Note: Every programme, including the choice of optional courses, has to be discussed and agreed upon with the master coordinator or a personal mentor and approved by the Examination Board.

Courses:

Name	Period	Credits	Code
Master Research Project Chemistry - Organic Chemistry	Ac. Year (September)	42.0	X_432598
Master Research Project Chemistry - Organic Chemistry - Extension	Ac. Year (September)	18.0	X_432599
Master Research Project Chemistry - Organic Chemistry - Extension	Ac. Year (September)	6.0	X_432618
Master Research Project Chemistry - Organic Chemistry - Extension	Ac. Year (September)	12.0	X_432685

Recommended optional Courses

The subject options of 36, 30, 24 or 18 credits can be completed with the possibilities below.

Note: Every programme, including the choice of optional courses, has to be discussed and agreed upon with the master coordinator or a personal mentor and approved by the Examination Board.

Courses:

Name	Period	Credits	Code
Advanced Spectroscopy	Period 6	6.0	X_432767
Bio-analysis & Clinical Diagnostics	Period 1	6.0	X_432765
Biosystems Data Analysis	Period 3	6.0	X_437001
Chemical Analysis for Forensic Evidence	Period 2	6.0	X_437003
Environmental Chemistry	Period 1	6.0	X_437004
High-Throughput Screening	Period 2	6.0	X_435047
Internship Biomolecular Analysis and Spectroscopy	Ac. Year (September)	18.0	X_432523
Internship Biomolecular Analysis and Spectroscopy	Ac. Year (September)	24.0	X_432524
Internship Biomolecular Analysis and Spectroscopy	Ac. Year (September)	30.0	X_432525
Internship Organic Chemistry	Ac. Year (September)	18.0	X_432529
Internship Organic Chemistry	Ac. Year (September)	24.0	X_432530
Internship Organic Chemistry	Ac. Year (September)	30.0	X_432531
Internship Theoretical Chemistry	Ac. Year (September)	18.0	X_432532
Internship Theoretical Chemistry	Ac. Year (September)	24.0	X_432533
Internship Theoretical Chemistry	Ac. Year (September)	30.0	X_432534
Minor Research Project Biomol. Analysis and Spectr.	Ac. Year (September)	18.0	X_432649
Minor Research Project Biomol. Analysis and Spectr.	Ac. Year (September)	24.0	X_432650
Minor Research Project Biomol. Analysis and Spectr.	Ac. Year (September)	30.0	X_432651
Minor Research Project Organic Chemistry	Ac. Year (September)	18.0	X_432640

Minor Research Project Organic Chemistry	Ac. Year (September)	24.0	X_432641
Minor Research Project Organic Chemistry	Ac. Year (September)	30.0	X_432642
Minor Research Project Theoretical Chemistry	Ac. Year (September)	18.0	X_432646
Minor Research Project Theoretical Chemistry	Ac. Year (September)	24.0	X_432647
Minor Research Project Theoretical Chemistry	Ac. Year (September)	30.0	X_432648
Organic Photovoltaics	Period 5	6.0	X_422590
Protein Analysis	Period 5	6.0	X_435045
The analytical Chemist in Industry	Period 4	6.0	X_437005

Optional Courses

Courses:

Name	Period	Credits	Code
Bio-Organic Chemistry	Period 2	6.0	X_435669
Coordination and Organometallic Chemistry	Period 2	6.0	X_435664
Heterogeneous Catalysis	Period 3	6.0	X_428013
Homogeneous Catalysis	Period 5	6.0	X_435668
Molecular Computational Chemistry	Period 5	6.0	X_435666
Nuclear Magnetic Resonance	Period 4	6.0	X_435667
Physical-Organic Chemistry	Period 1	6.0	X_435663
Supramolecular Chemistry and Nanomaterials	Period 1	6.0	X_435653
Synthetic Organic Chemistry	Period 4	6.0	X_435665

Compulsory Courses

Verplicht keuze van 4 uit deze 8 vakken: X_435663, X_435664, X_435665, X_435666,
X_435667, X_435668, X_435669, X_435653

Courses:

Name	Period	Credits	Code
Literature Thesis and Colloquium Chemistry - Organic Chemistry	Ac. Year (September)	12.0	X_432583

Research Variant Molecular Simulation & Photonics

The progamme consists of 120 credits.

Note: Every programme, including the choice of optional courses, has to be discussed and agreed upon with the master coordinator or a personal mentor and approved by the Examination Board.

Master Coordinator:

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Programme components:

- Compulsory Choice Ethics and Portfolio academic Skills
- Compulsory Optional Course Research project (Major) including Report
- Literature Thesis and Colloquim
- Compulsory Optional Courses
- Recommended Optional Courses Computational Chemistry
- Compulsory Courses

Compulsory Choice Ethics and Portfolio academic Skills

Students need to select a total of 6 credits from the following list.

Note: Every programme, including the choice of optional courses, has to be discussed and agreed upon with the master coordinator or a personal mentor and approved by the Examination Board.

Courses:

Name	Period	Credits	Code
English Academic Course	Period 2+3, Period 5+6	3.0	X_437028
Science in Perspective	Period 4+5	6.0	X_437030
Teaching Assistant	Ac. Year (September)	3.0	X_432741
Teaching Assistant	Ac. Year (September)	6.0	X_432742
Tutoring Students	Period 2	3.0	X_432625

Compulsory Optional Course Research project (Major) including Report

Compulsory choice of at least 42 credits. Optional extension of 6, 12 or 18 credits.

Note: Every programme, including the choice of optional courses, has to be discussed and agreed upon with the master coordinator or a personal mentor and approved by the Examination Board.

Courses:

Name	Period	Credits	Code
Master Research Project Molecular Simulation and Photonics	Ac. Year (September)	42.0	X_432681
Master Research Project Molecular Simulation and Photonics - ext	Ac. Year (September)	6.0	X_432682
Master Research Project Molecular Simulation and Photonics - ext	Ac. Year (September)	12.0	X_432683
Master Research Project Molecular Simulation and Photonics - ext	Ac. Year (September)	18.0	X_432684

Literature Thesis and Colloquim

Students need to select a total of 12 credits or more from the following list.

Note: Every programme, including the choice of optional courses, has to be discussed and agreed upon with the master coordinator or a personal mentor and approved by the Examination Board.

Courses:

Name	Period	Credits	Code
Colloquium and Literature Thesis	Ac. Year (September)	12.0	X_432679
Literature Thesis and Colloquium Chemistry - Physical Chemistry	Ac. Year (September)	12.0	X_432582
Literature Thesis and Colloquium Chemistry - Theoretical Chemistry	Ac. Year (September)	12.0	X_432584

Compulsory Optional Courses

Choose 2 of 4

Courses:

Name	Period	Credits	Code
Advanced Experimental Techniques	Period 6	6.0	X_432662
Ultrafast Laser Physics	Period 4	6.0	X_422556
Understanding Molecular Simulation	Period 3	6.0	X_432703
Understanding Quantum Chemistry	Period 2	6.0	X_422557

Recommended Optional Courses Computational Chemistry

The subject options of 36, 30, 24 or 18 credits can be completed with courses in
- Computational Chemistry
- Physical Chemistry
- Physcis of Light & Matter
- Physicss of Life & Health

Below the recommended courses in Computational Chemistry.

Note: Every programme, including the choice of optional courses, has to be discussed and agreed upon with the master coordinator or a personal mentor and approved by the Examination Board.

Courses:

Name	Period	Credits	Code
Ab Initio Molecular Dynamics	Period 5	6.0	X_435635
Advanced Quantum Chemistry	Ac. Year (September)	6.0	X_432847
Advanced Quantum Chemistry	Ac. Year (September)	12.0	X_432848
Applied Theoretical Chemistry	Period 4	6.0	X_435612
Biomolecular Simulations	Period 4	6.0	X_437019
Density Functional Theory for Chemists	Ac. Year (September)	6.0	X_435111
Density Functional Theory for Chemists	Ac. Year (September)	12.0	X_435112
Medical Imaging	Period 4	6.0	X_428526
Molecular Photodynamics	Period 4	3.0	X_432701
Numerical Techniques	Period 4+5	6.0	X_420082
Scientific Programming	Period 2	6.0	X_435076
Soft Condensed Matter and Biological Physics	Period 2	6.0	X_420167
Supramolecular Chemistry and Nanomaterials	Period 1	6.0	X_435653
Transport Phenomena	Period 4+5	6.0	X_420075

Compulsory Courses

Students need to follow two courses in period 1 of year 1 and one course in period 1 of year 2.

Courses:

Name	Period	Credits	Code
Lasers and Quantum Optics	Period 1	6.0	X_422539

Quantum Theory of Molecules and Matter	Period 1	6.0	X_428517
Statistical Theory of Complex Molecular Systems	Period 1	6.0	X_428520

Specialization Science, Business & Innovation

The MSc-SBI program outlined below features two thematic lines: (1) life science, with an emphasis on drug development, molecular diagnostics and innovative medical instrumentation, and (2) energy science, with an emphasis on sustainable energy development. This program, combining the natural sciences with innovation skill sets from a business and organizational perspective is spread across a two-year MSc-program. The program is full time and taught in English. To obtain an MSc degree in SBI, students must earn 120 credits (EC) in courses according to the scheme below.
1.Natural sciences 36 EC
a. Science courses 12 EC
Compulsory choice:
b1. Science project (incl literature research and research skills)24 EC
or b2. Researching science research 12 EC and Track courses 12 EC
2. Business and Social sciences 24 EC
3. Science, Business and Innovation 42 EC
a. SBI course 6 EC
b. SBI project (internship and master thesis) 36 EC
4. Complementary and/or electives 18 EC
In this program, students will be exposed to mandatory science classes, i.e. life science and/or energy science, to strengthen their background in natural sciences fundamentals. In addition, depending on the background of the students (either SBI BSc or other Bachelor degreed) there will be possibilities to define an appropriate customized MSc program. The chosen core will be complemented with a science project (24 EC) or the combination of Researching science research (12 EC) and Track courses (12 EC) for specialization in an area of interest, in either
Life or Energy
science and with 24 EC in social and business sciences. The courses in social and business sciences focus on the processes and organizational context of innovation trajectories in business, industry and on institutional settings of inventions in life science and energy science and sustainability. The MSc-SBI is finalized through a final SBI-project of 36 EC (usually an internship at a company or institute) integrating the science, business and social aspects, leading to a Master's Thesis.

Programme components:

- Compulsory Choice 1 out of 2
- Compulsory Choice of 12 EC
- Compulsory Choice of 24 EC
- Recommended electives
- Compulsory Courses

Compulsory Choice 1 out of 2

Courses:

Name	Period	Credits	Code
Business, Innovation and Value Creation in the Life Science Industry	Period 3	6.0	X_432723
Current Sustainable Energy Technologies	Period 3	6.0	X_422582

Compulsory Choice of 12 EC

Compulsory Choice of 12 EC from 1 of the following Science courses:
L&H:
Biomedical modeling and simulation 6 EC
Principles of Pharmaceutical Sciences/Pharmacochemistry 6 EC
Protein science 6 EC
Innovation in medical technology 6 EC
Chemical biology 6 EC
Green chemistry 6 EC

E&S:
Biosolar cells 6 EC
Chemical biology 6 EC
Green chemistry 6 EC
Photovoltaics 6 EC
Project sustainable future 6 EC
Materials for energy and environmental sustainability 12 EC

Courses:

Name	Period	Credits	Code
Biomedical Modelling and Simulation	Period 1	6.0	X_430112
BioSolar Cells	Period 1	6.0	X_428531
Chemical Biology	Period 1	6.0	X_432538
Green Chemistry	Period 1	6.0	X_430557
Innovation in Medical Technology to Improve the Health Care System	Period 6	6.0	X_430602
Organic Photovoltaics	Period 5	6.0	X_422590
Principles of Pharmaceutical Sciences / Pharmacochemistry	Period 1	6.0	X_435675
Project Sustainable Future	Period 6	6.0	X_432784
Protein Science	Period 1	6.0	AM_470145

Compulsory Choice of 24 EC

Courses:

Name	Period	Credits	Code

Business & Innovation Project	Ac. Year (September)	24.0	X_432845
Materials for energy and environmental sustainability	Period 4+5	12.0	X_432850
Researching science research	Period 4+5	12.0	X_432849
Science project	Ac. Year (September)	24.0	X_422591

Recommended electives

The students have to choose elective courses of 18 EC at the MSc level which have to be approved by the Examination Committee.

Courses:

Name	Period	Credits	Code
Science and Society in Historical Perspective	Period 4+5	6.0	X_400424
Technology and Innovation Processes	Period 2	6.0	E_BA_TIP

Compulsory Courses

Courses:

Name	Period	Credits	Code
Management of Sustainable Innovation	Period 2	6.0	X_432739
Networked Organizations and Communication	Period 2	6.0	S_NOC
SBI Project & Master Thesis	Ac. Year (September)	36.0	X_432735
SBI Research Methodology	Ac. Year (September)	6.0	X_432846
Transdisciplinarity and Transition	Period 2	6.0	X_430604

Specialization Science for Energy and Sustainability

Programme components:

- Compulsory Choice of at least 24 ec.
- Compulsory Choice Ethics and Portfolio Academic Skills
- Compulsory Choice Master Project
- Compulsory Courses

Compulsory Choice of at least 24 ec.

Courses:

Name	Period	Credits	Code
BioSolar Cells	Period 1	6.0	X_428531
Catalysis for sustainable energy	Period 4	6.0	X_437027
Coordination and Organometallic Chemistry	Period 2	6.0	X_435664
Emergent Energy Materials	Period 1	6.0	X_428571
Energy and Climate Change; Science, Policy and Economics	Period 2	6.0	X_428568
Environmental Chemistry	Period 1	6.0	X_437004
Green Chemistry	Period 1	6.0	X_430557
Heterogeneous Catalysis	Period 3	6.0	X_428013
Homogeneous Catalysis	Period 5	6.0	X_435668
Open Innovation in Science and Sustainability	Period 2	6.0	X_422598
Organic Photovoltaics	Period 5	6.0	X_422590
Photosynthesis and Energy	Period 5	6.0	X_422553
Photovoltaics	Period 4	6.0	X_428516

Compulsory Choice Ethics and Portfolio Academic Skills

Compulsory choice of at least 6 ec

Courses:

Name	Period	Credits	Code
Science in Perspective	Period 4+5	6.0	X_437030
Tutoring Students	Period 2	3.0	X_432625

Compulsory Choice Master Project

Students need to select one of the courses from the following list. The sum of the Master project and Minor project must be at least 54 credits.

Courses:

Name	Period	Credits	Code
Master Project SfES	Ac. Year (September)	30.0	X_422593
Master Project SfES	Ac. Year (September)	36.0	X_422594
Master Project SfES	Ac. Year (September)	42.0	X_422595
Master Project SfES	Ac. Year (September)	48.0	X_422596
Master Project SfES	Ac. Year (September)	54.0	X_422597

Compulsory Courses

Courses:

Name	Period	Credits	Code
Current Sustainable Energy Technologies	Period 3	6.0	X_422582
Literature Thesis SES	Ac. Year (September)	6.0	X_432785
Project Sustainable Future	Period 6	6.0	X_432784

Society Oriented Variant for Natural and Life Sciences

Due to the growing complexity of technological and medical issues and the interaction with society, organisations working in this sector have a growing and urgent need for academic professionals in the natural and life sciences, who have knowledge of policy management and entrepreneurship. The Society oriented variant offers students with a bachelor degree in the natural and life sciences the chance to combine a specialization in this field with a specialization in research.

Programme

The programme of the Society oriented variant is equal to the first year of the master programme Management Policy- Analysis and entrepreneurship (MPA). The programme of the Society oriented variant consists of 60 EC (18 EC compulsory courses; 12 EC optional courses and 30 EC internship) The course language is English, unless all students participating in the course speak Dutch, the course language will be Dutch.

Apart from the communication courses, the student has to choose 60 EC Chemistry courses. The student has to discuss the programme with the master coordinator of the chosen specialisation.

Programme components:

- Optional Courses Social Variant
- Compulsory Courses Social Variant

Optional Courses Social Variant

Compulsory choice of 18 credits

Courses:

Name	Period	Credits	Code
Business Management in Health and Life Sciences	Period 2	6.0	AM_470584
Clinical Development and Clinical Trials	Period 3	3.0	AM_1180
Disability and Development	Period 2	6.0	AM_470588

Entrepreneurship in Health and Life Sc.	Period 2	6.0	AM_470575
Epidemiology	Period 3	3.0	AM_1179
Health, Globalisation and Human Rights	Period 2	6.0	AM_470818
Policy, Politics and Participation	Period 2	6.0	AM_470589
Research methods for analyzing complex problems	Period 1	6.0	AM_1182
Science Museology	Period 3	6.0	AM_470590

Compulsory Courses Social Variant

In addition to the courses below a total of at least 18 EC of track specific courses has to be chosen in consultation with the master coordinator.

Courses:

Name	Period	Credits	Code
Analysis of Governmental Policy	Period 1	6.0	AM_470571
Colloquium and Literature Thesis	Ac. Year (September)	6.0	X_432580
Communication, Organization and Management	Period 2	6.0	AM_470572
Internship Societal Specialisation	Ac. Year (September)	30.0	AM_471147
Master Research Project Society Oriented Variant	Ac. Year (September)	36.0	X_432588

(Bio)Molecular Spectroscopy

Course code	X_435062 (435062)
Period	Period 5
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	prof. dr. G.W. Somsen
Examinator	prof. dr. G.W. Somsen
Teaching staff	prof. dr. G.W. Somsen
Teaching method(s)	Lecture
Level	400

Course objective
This course deals with interactions between light and molecules as studied and employed by optical spectroscopy. Goal of the course is to acquire a deeper knowledge of several spectroscopic principles and

techniques frequently applied in (bio)analytical chemistry.

Course content
The course will start with an introduction to photophysical principles and fundamentals of molecular spectroscopy. Basic aspects of molecular orbitals, electronic transitions and quantummechanics will be treated. Basic properties of light and principal optical instrumentation will be discussed. The fundamentals, practice and applications of electronic spectroscopy (UV/Vis absorption, fluorescence, phosphorescence) and vibrational spectroscopy (infrared, Raman) will be systematically treated.

Form of tuition
Lecture (h): 30 hrs
Seminar/werkcollege (w): 12 hrs

Type of assessment
Written examination (T)

Course reading
Lectures and problem solving sessions.

Entry requirements
Basic knowlegde on chemical structure, bonds and hybridization.

Recommended background knowledge
Basic principles of molecular orbitals, energy levels and molecular vibrations. Basic experience with absorption spectrometry.

Target group
mCh-AS

Ab Initio Molecular Dynamics

Course code	X_435635 (435635)
Period	Period 5
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Level	500

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/15045

Target group
mCh-MSP

Remarks
This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.
Enrolment via https://m.sis.uva.nl/vakaanmelden is required.

Advanced Experimental Techniques

Course code	X_432662 (432662)
Period	Period 6
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Teaching method(s)	Lecture, Practical
Level	500

Course objective
To provide a broad overview of advanced experimental techniques, equipment and measurement concepts, and their application in modern research in the physical and life sciences.

Course content
This course covers both the principles and the building blocks of experimental measurement techniques and their applications in physics, chemistry and life sciences. We will discuss the basics and state-of-the-art implementations of vacuum technology, optical and wavelength dispersing components, electronics and measurement devices, photon and particle detectors, harged particle optics and imaging. This is integrated with measurement and experimental concepts like molecular beams, ionization and fluorescence spectroscopy, sub-Doppler and Cavity-Ring-Down spectroscopy, multidimensional spectroscopy, coincidence electron and ion imaging, and microscopy. Applications of these advanced measurement techniques in studies of atomic, molecular and (bio)material in physical and life sciences will be reviewed using recent Review Papers.

Form of tuition
A combination of lectures, exercises and assignments, demonstrations; in total 42 hours.

Type of assessment
To be decided.

Course reading
Moore, J.H., Davis, C.C., and Coplan, M.A. Building Scientific Apparatus 4th ed. Cambridge University Press, 2009.
Review articles.

Target group
mCH

Advanced Quantum Chemistry

Course code	X_432847 ()
Period	Ac. Year (September)
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	prof. dr. L. Visscher
Examinator	prof. dr. L. Visscher
Level	500

Course objective
Provide detailed working knowledge of the methods commonly employed in computational chemistry and physics. This will allow students to actively contribute to the development of new electronic structure methods.

Course content
The course builds on the course Understanding Quantum Chemistry by providing a detailed treatment of one of the following two topics.

1) Methods based on the relativistic Dirac equation as they are used in quantum chemical calculations on heavy elements. Keywords are: Theory of special relativity. Dirac equation. Quantum Electro Dynamics. One-electron atoms. The Dirac-Hartree-Fock method. Approximation schemes. Relativistic effects in heavy-element chemistry.

2) The methods of second quantization as they are used in quantum chemistry to develop wave-function based electron correlation methods. Keywords are: Fock space and formulation of the second quantization approach. Expression of operators in second quantized form. Treatment of electron spin. Use in orbital optimization. Application to a selected number of standard methods in quantum chemistry. Method callibration and validation.

Form of tuition
Depending on the group size, either self study or lectures, and exercises.

Type of assessment
Written exam.

Course reading
Depending op the topic either

1) Relativistic Quantum Chemistry, K. G. Dyall, Oxford University Press.

2) Molecular Electronic Structure Theory. Helgaker, Jørgensen, Olsen. Wiley.

Entry requirements
Understanding Quantum Chemistry

Target group
mChem-MSP

Remarks
The course will run in the second semester, preferably in period 4 or 5. Students are encouraged to contact the teacher in December, indicating which of the two topics they would like to study. For students who like to study both topics, the 12 EC variant of this course will apply.

Advanced Quantum Chemistry

Course code	X_432848 ()

Period	Ac. Year (September)
Credits	12.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	prof. dr. L. Visscher
Examinator	prof. dr. L. Visscher
Level	500

Course objective
Provide detailed working knowledge of the methods commonly employed in computational chemistry and physics. This will allow students to actively contribute to the development of new electronic structure methods.

Course content
The course builds on the course Understanding Quantum Chemistry by providing a detailed treatment of the following two topics.

1) Methods based on the relativistic Dirac equation as they are used in quantum chemical calculations on heavy elements. Keywords are: Theory of special relativity. Dirac equation. Quantum Electro Dynamics. One-electron atoms. The Dirac-Hartree-Fock method. Approximation schemes. Relativistic effects in heavy-element chemistry.

2) The methods of second quantization as they are used in quantum chemistry to develop wave-function based electron correlation methods. Keywords are: Fock space and formulation of the second quantization approach. Expression of operators in second quantized form. Treatment of electron spin. Use in orbital optimization. Application to a selected number of standard methods in quantum chemistry. Method callibration and validation.

Form of tuition
Depending on the group size, either self study or lectures, and exercises.

Type of assessment
Two written partial exams. A passing grade should be obtained for both of them.

Course reading
1) Relativistic Quantum Chemistry, K. G. Dyall, Oxford University Press.

2) Molecular Electronic Structure Theory. Helgaker, Jørgensen, Olsen. Wiley.

Entry requirements
Understanding Quantum Chemistry

Target group
mChem-MSP

Registration procedure

Contact the teacher in December.

Remarks
The course will run in the second semester, spanning period 4 and 5.

Advanced Separation Sciences

Course code	X_432844 ()
Period	Period 3
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Level	400

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/22331

Remarks
This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.
Enrolment via https://m.sis.uva.nl/vakaanmelden is required.

Advanced Spectroscopy

Course code	X_432767 ()
Period	Period 6
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. F. Ariese
Examinator	dr. F. Ariese
Teaching staff	dr. F. Ariese
Teaching method(s)	Lecture
Level	500

Course objective
To acquire a deeper insight into the basic principles and modern developments of molecular spectroscopy in (bio)analytical chemistry, with emphasis on fluorescence/luminescence and Raman techniques.
To become familiar with recent literature on the use of these techniques in a variety of applications.
To acquire practical skills in modern (laser) spectroscopy.

Course content
The topics discussed comprise the basic principles of fluorescence/phosphorescence and Raman spectroscopy. Attention will be given to energy transfer mechanisms and the use of fluorescent probes, high-resolution fluorescence at cryogenic temperatures, single-molecule spectroscopy and coupling to analytical separation techniques. Raman spectroscopic topics will include surface-enhanced Raman, resonance Raman, time-resolved Raman and non-linear Raman techniques. Instrumental

aspects, such as laser excitation, time-resolved detection, polarization and imaging will also be covered in this course.
Recent examples of the use of these techniques in a chemistry, medical, environmental, industrial, forensic or space research context will be discussed on the basis of literature presentations by the students. The course also includes a set of fluorescence and Raman experiments at VU LaserLaB

Form of tuition
Lectures, tutorials
In small groups the students will carry out a set of experiments, of which the results will be laid down in a report and an oral presentation.
The students will also prepare a presentation on a recent literature article, to be given and discussed in class.

Type of assessment
The final grade will be determined based on
Experiment report (1/6)
Experiment presentation (1/6)
Literature presentation (1/6)
Written exam (3/6)

Course reading
Handouts and literature articles will be provided by the lecturer

Recommended background knowledge
Background knowledge of molecular spectroscopic techniques, in particular fluorescence and Raman, is expected (for instance MSc Chem course (bio)molecular spectroscopy or 3MNW/2N course Microscopy and Spectroscopy). When in doubt please contact the lecturer.

Target group
MSc Chemistry, MSc Medical Natural Sciences

Advanced Statistics for Analytical Chemistry

Course code	X_437589 ()
Period	Period 5
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Level	400

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/1132316

Remarks
This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.
Enrolment via https://m.sis.uva.nl/vakaanmelden is required.

Analysis of Governmental Policy

Course code	AM_470571 ()
Period	Period 1
Credits	6.0
Language of tuition	English
Faculty	Fac. der Aard- en Levenswetenschappen
Coordinator	M.J. Kishna
Examinator	prof. dr. J.T. de Cock Buning
Teaching staff	prof. dr. J.T. de Cock Buning
Teaching method(s)	Lecture, Study Group, Computer lab
Level	500

Course objective
- To acquire critical knowledge regarding different policy models and theories
- To master the correct use of central concepts in political and policy discourses.
- To further deepen your analytic skills with respect to the critical assessment of a complex societal question or dilemma in the health and life science;
- To learn to integrate science- specific knowledge with the knowledge and skills of other disciplines of the social sciences
- To practice skills in data collection and analysis
- To learn to set up valid lines of argumentation;
- To learn to translate research findings into policy recommendations;
- To get experienced in writing a policy advisory report;
- To improve your communication skills;
- To improve your skills in working effectively in a project team, through team building, team analysis and feedback.

Course content
Governmental policy affects millions of people and is thus object of intensive debate and target of strong societal forces, like political parties, media and interest groups. Being an advisor or policy maker requires a thorough understanding of the dynamics of policy making, as well as from the psychologal side as from the more social structures and their influence on a deliberative democracy.
The course contains several lectures on theoretical concepts and models concerning policy analysis. Furthermore you will be challenged, under supervision, to apply and practice these concepts and models in the project assignment. From the very first day, you will be part of a project team of about ten students. You are confronted with a real policy problem from an external commissioning institution (e. g. a non-governmental organization, a Ministry, an advisory council). Within those 4 weeks you will collect data by literature review and interviews and conduct an interdisciplinary analysis on the basis of which you provide an advice. Specific attention is paid to working in a project team and team building. At the end of the course, you prepare an advisory report. On the last day of the course you present the report to the representative of the external institution who commissioned the project. In that presentation your team will highlight the main results of your analysis and defend the recommendations you propose.

Form of tuition
Analysis of Governmental Policy is a fulltime course of four weeks (6 ECTS). The most recent course schedule is to be found on Blackboard.

Tuition methods include lectures, training workshops, and self-study. The different elements have the following study time:
- lectures: 15 hours
- project and self-study: remaining hours (within the project: 18x 1 hour coach meeting)
- examination: 2 hours

Please note that attendance to the project meetings is compulsory. Attendance to the lectures is highly recommended. In our experience, relying on self-study alone is insufficient to pass the exam

Type of assessment
Written exam (25%) and individual evaluation based on personal performance in the project team (50%), and assessment of various group products (report and presentation (25%)). All parts have to be passed successfully.

Course reading
Buse, Mays and Walt: "Making Health Policy" McGrawHill/Open University press. (at least 2nd edition 2012).

Recommended background knowledge
The project integrates the learned lessons from the first compulsory MPA courses: Qualitative & Quantitative Methods.\

Target group
Compulsory course within the Masterprogramme Management, Policy Analysis and entrepreneurship for the health and life sciences (MPA) and the Societal differentiation of Health, Life and Natural Sciences Masters programmes.

Remarks
The case is policy analysis and advice, but the exercised methods and skills are equally applicable to strategic marketing advice or evaluation studies. The teams will be coached by workgroup leaders.

Applied Theoretical Chemistry

Course code	X_435612 (435612)
Period	Period 4
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	prof. dr. F.M. Bickelhaupt
Examinator	prof. dr. F.M. Bickelhaupt
Teaching staff	prof. dr. F.M. Bickelhaupt
Teaching method(s)	Education, Computer lab
Level	500

Course objective
Understanding and predicting molecular structure and chemical reactivity.

Course content

Theoretical Chemistry has become an integral part of modern chemistry. Numerous properties can be computed with chemical accuracy, thus, enabling one to study or predict quantities that are hardly or not al accessible through experimental techniques. But with this, the potential of theoretical chemistry is still not exhausted. In order to design syntheses, catalysts or pharmacologically active molecules in a more rational fashion (i.e., instead of using a trial-and-error approach), it is of crucial importance to combine accuracy with solid and profound insight into the underlying mechanisms in the electronic structure. This holds true also if such investigations are done in the form of computational chemistry. Such insight can be obtained through detailed analyses of the computed wavefunction and bond energy. The purpose of this course is to acquire the skills that one needs for a minute understanding of the nature of a chemical phenomenon. Here, the molecular orbital (MO) model contained in the so-called Kohn-Sham density functional theory plays a pivotal role.

Form of tuition
The course consists of an intensive theoretical introduction in the first week followed by a research project in which the student participates in one of the research lines of the group.

Type of assessment
Examination of the course occurs on the basis of a research report.

Course reading
Parts of: (a) T. A. Albright, J. K. Burdett, M.-H. Whangbo, Orbital Interactions in Chemistry, Wiley-Interscience, New York, 1985; (b) F.M. Bickelhaupt, E.J. Baerends, Kohn-Sham Density Functional Theory: Predicting and Understanding Chemistry, in: Rev. Comput. Chem.; K.B. Lipkowitz, D.B. Boyd, Eds.; Wiley-VCH: New York, Vol. 15.

Target group
mCh, mDDS

Remarks
This course exists in two variants. The first variant is worth 6 cp (code 435612) and can be extended to 12 cp (code 432501).

Bio-analysis & Clinical Diagnostics

Course code	X_432765 ()
Period	Period 1
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. H. Lingeman
Examinator	dr. H. Lingeman
Teaching staff	dr. H. Lingeman
Teaching method(s)	Lecture
Level	400

Course objective
Giving a clear account on the instrumental bio-analytical techniques and strategies in bio-analysis an clinical diagnostics.

Course content
This basic course on bio-analytical and clinical chemistry is focusing on decision trees (strategic decisions) that can be used during the method development and optimization of analytical procedures to determine both endogenous and exogenous compounds in complex biological samples. Approaches and procedures with respect to sampling, sample preparation, separation, spectroscopy, electrochemistry, as well as immunological and enzymatic procedures will be dealt with. Case studies will be used to clarify the decisions that have to be taken.

Form of tuition
Lectures and tutorials.

Type of assessment
Written or oral examination.

Course reading
Hand-outs (electronically available).

Recommended background knowledge
Basic knowledge of biochemistry, chromatography, electrophoresis and mass spectrometry.

Target group
mCH-AS, mDDS, mMNS

Biomedical Modelling and Simulation

Course code	X_430112 (430112)
Period	Period 1
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. I.H.M. van Stokkum
Examinator	dr. I.H.M. van Stokkum
Teaching staff	dr. I.H.M. van Stokkum, dr. ir. T.J.C. Faes, dr. J.C. de Munck, prof. dr. G.J.M. Stienen
Teaching method(s)	Lecture, Seminar, Practical, Study Group
Level	400

Course objective
To gain knowledge of the most important theoretical and practical concepts in modelling and simulation of biomedical processes at different scales, ranging from macroscopic organ function, cellular function down to biochemical interactions and signaling pathways within cells.

To gain experience with and to apply MatLab and Mathematica to acquire, analyse and evaluate biomedical signals and to model and simulate biomedical processes.

Course content
This course will start with a general overview the various types of models used to describe biomedical processes by parametric and

non-parametric models using linear and non linear (differential) equations. Basic knowledge of vector and matrix calculations and differential equations is required but will be refreshed.

During the course, attention will be paid to viscoelastic models, spectral analysis, compartment models, geometric modelling used in image analysis and models to describe molecular structures and their dynamic behaviour.

Examples will concentrate on cardiovascular function: linear and nonlinear
viscoelastic models of pressure volume relations, compartment models of the interaction between contractile proteins to simulate force and pressure development and a description of an ion pump for instance to import Ca-ions into the cell during an action potential.

The introductory lectures will be combined and followed by practical courses in which, through exercises, experience will be gained of MatLab and Mathematica (4th generation computer languages). Finally students will be offered a choice of 1 out of 5 modelling problems to be solved in small groups, guided by a supervisor. At
the end of the course each group will present and discuss their work with all participants and supervisors of the course.

Form of tuition
Lectures, working groups, assignments.

Type of assessment
Assignments (20%), report and presentation on modelling problem (40%) and written exam (40%).

Course reading
Syllabus.
Book (recommended): Gilat, A., MatLab: An Introduction with Applications, 5th ed, Wiley.

Target group
mCh-SBI, mMNS-MPs, mMNS-PoL, mMNS-MPy, mPhys-PLH, mPhys-SBI

Biomolecular Simulations

Course code	X_437019 (437019)
Period	Period 4
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Teaching method(s)	Lecture
Level	500

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/18654

Remarks
This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.

Enrolment via https://m.sis.uva.nl/vakaanmelden is required.

Bio-Organic Chemistry

Course code	X_435669 (435669)
Period	Period 2
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	prof. dr. ir. R.V.A. Orru
Examinator	prof. dr. ir. R.V.A. Orru
Teaching staff	prof. dr. ir. R.V.A. Orru
Teaching method(s)	Lecture
Level	400

Course objective
The use of Biotransformations in Synthesis as well as advanced understanding of Natural Product Chemistry.

Course content
This course gives an overview of the most important classes of biocatalysts. It describes the properties of biocatalysts and their use in biotransformations. The advantages and disadvantages of the use of enzymes will be discussed as well as the basic principles in enzyme-catalyzed asymmetric synthesis. Further, a detailed overview of the fundamental classes of Natural Products is given. Thus, Terpenes and Steroids. Alkaloids, Fenolics, Fatty acids and Prostaglandines, Polyketides will be covered. Not only the basic structural and physical properties but also synthetic aspects and bio-synthesis are a major part of this course.

Form of tuition
Lectures, tutorials, assignments

Type of assessment
Written examination and assignments

Course reading
Will be provided by the lecturers.

Entry requirements
BSc

Target group
mCh-MDSC

BioSolar Cells

Course code	X_428531 ()
Period	Period 1
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen

Coordinator	dr. J.P. Dekker
Examinator	dr. J.P. Dekker
Teaching staff	dr. J.P. Dekker, dr. R.N. Frese
Teaching method(s)	Lecture
Level	400

Course objective
To obtain insight in the three main themes of BioSolar Cells (in short research to improve the efficiency of photosynthesis in plants, research to produce biofuel or other products from algae on a semi-industrial scale and research to convert solar energy directly into a fuel in an artificial leaf with very high efficiency), and to perform a literature study on one of the themes from BioSolar Cells.

Course content
BioSolar Cells is a Dutch national research programme with the aim to optimize the photosynthesis process in plants, algae and bacteria, and to develop ‘artificial leaves’ that combine physical and chemical components. The course will start with interactive lectures by experts on each of the three themes from BioSolar Cells. The students will have to read one or two papers before each lecture and formulate research questions, after which the lecturer gives his/her lecture and the questions are discussed. In the second stage of this course, the students choose a research topic, conduct a literature study, prepare a scientific review paper and present their work in a session with all participating students and staff.

Form of tuition
Interactive lectures and literature study.

Type of assessment
Assessment of scientific review article and of a presentation.

Course reading
Scientific papers

Target group
mCh-SES, mPhys, mPhys-SBI, mCh-SBI

Biosystems Data Analysis

Course code	X_437001 (437001)
Period	Period 3
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Level	400

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/19661

Remarks
This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904,

servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.
Enrolment via https://m.sis.uva.nl/vakaanmelden is required.

Business & Innovation Project

Course code	X_432845 ()
Period	Ac. Year (September)
Credits	24.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. J.P. Dekker
Examinator	dr. J.P. Dekker
Level	400

Course objective
This project is an alternative for the Science Project (X-422591), but only for those students who have performed a science-based project during their bachelor program, like students with completed chemistry, physics or related bachelors programs.

Course objective is similar to that of the Science Project, but a science base is not required.

Course content
See Science Project, except that this project is based on business and innovation instead of science.

Type of assessment
Report and presentation

Business Management in Health and Life Sciences

Course code	AM_470584 ()
Period	Period 2
Credits	6.0
Language of tuition	English
Faculty	Fac. der Aard- en Levenswetenschappen
Coordinator	prof. dr. H.J.H.M. Claassen
Examinator	prof. dr. H.J.H.M. Claassen
Teaching staff	prof. dr. H.J.H.M. Claassen
Teaching method(s)	Lecture, Computer lab
Level	500

Course objective
To acquire knowledge and understanding into theory of knowledge valorisation in health and life sciences
To acquire knowledge and insight in how to organise, protect and finance a business in health and life sciences
3To acquire knowledge and understanding into the pharmaceutical industry's business model and business processes
To acquire knowledge and understanding into the challenges that face the pharmaceutical industry

To apply newly acquired knowledge and understanding in writing a business plan
To apply newly acquired knowledge and understanding by solving case examples
To reflect on and critically evaluate the role of the pharmaceutical industry in the healthcare system
To learn to autonomously write a business plan

Course content
As a result of external factors (for example ageing of the population), it is being stated that our healthcare system is under pressure. As a central stakeholder in this healthcare system, the pharmaceutical industry is facing significant challenges the coming years and more than ever, the pharmaceutical industry is challenged to survive. Business Management in the Health and Life Sciences focuses on gaining insight in the pharmaceutical industry, its business model, business processes, challenges, as well as strategies and actions to overcome these challenges.

During the course, prof.dr. Eric Claassen (http://www.falw.vu.nl/en/research/athena-institute/staff/claassen.asp) together with highly experienced guest lecturers from the field will teach theoretical and practical knowledge during lectures and seminars. Tangible subjects that will be discussed during the lectures and seminars include the pharmaceutical industry's business model and business processes, intellectual property, portfolio management, finance, risk capital, grants and subsidies, team building and people management, different legal entities, fiscal and legal aspects when starting a new company, SWOT analysis in the life sciences and clinical trials.

The newly acquired knowledge is tested via an assignment (during which students will write either a personal career business plan or a 'real' business plan) and a written exam, both counting for 50% of the final grade.

Form of tuition
Lectures:35h
Assignment: 4h
Work on assignment (self study): 40h
Self-study: remaining hours

Type of assessment
Written exam: 50%
Personal Business Plan: 50%
Both have to be passed

Course reading
• Osterwalder, A. & Pigneur, Y. (2009). Business model generation. Self-published.
• Kubr, Marchesi & Ilar (McKinsey & company). (1998). Starting up. Achieving success with professional business planning. McKinsey & Company, Inc. The Netherlands, Amstel 344, 1017 AS Amsterdam.

Target group
Optional course for Master students Management, Policy Analysis and Entrepreneurship in Health and Life Sciences (MPA), Societal differentiation of the Health, Life & Natural Sciences.

Remarks
Guest lecturers/organisations:
• Robert Al, TU Eindhoven
• Tamar Weenen, VU university
• Esther Pronker, VU university
• Patrick de Boer & Jochem Bosschenbroek, Ttopstart BV
• Bart van Weezenbeek
• Bart Bergstein, Forbion Capital partners
• Michael Mellink & Majorie Soeter, Odgersberndtson
• Marga Janse, innovatief LerenLeren BV
• NL Octrooicenrtum
• Price Waterhouse Coopers
• AsjesBisseling Belastingadviseurs
• And others to be announced

Business, Innovation and Value Creation in the Life Science Industry

Course code	X_432723 ()
Period	Period 3
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	drs. P. van Hoorn
Examinator	drs. P. van Hoorn
Teaching staff	prof. dr. I.J.P. de Esch, drs. P. van Hoorn
Teaching method(s)	Lecture
Level	500

Course objective
Business Innovation and Value Creation in the Life Sciences Industry aims to provide two distinct goals:
a. To provide in depth and comprehensive insight in current business , innovation and entrepreneurship trends, approaches and state-of-the-art practice in the LSI through theory, literature and case analysis.
b. To utilize and apply insights and experiences gained under a. in a personal live entrepreneurship case in which each individual student elects a
case. And develops a business plan according to a set methodology. Essential parts of this process include: building strategy, business modeling, transactional modelling, building a value proposition, leveraging
IP, marketing and commercialization planning.

Course content
The LSI landscape is shown in several ways:
1. Understanding the Pharma Biotech and Health Care sectors and its primary and secondary drivers, including the contributing sciences
2. Understanding relevant business, value chain and innovation models that are common in these industries and sectors
3. Understanding typical product life-cycle dynamics in the Pharma and Biotech and related Health sectors
4. Understanding the relative contribution and position of Genomics, Proteomics and other scientific specialization areas in the future of Health and Life Sciences

5. Understanding current product categories and the future of diagnosis, therapy and prevention
In addition to lectures on the above topics, students will be handed certain texts and articles that illustrate the `State of the Art' in the LSI sector from both a product development as well as from a business development standpoint.
As a result the student will get insight into the business decisions and dynamic that are linked to basic bio-scientific research from inception through to product development and commercialization. The course thus aims to provide a general overview of how life science and business are interwoven in everyday industrial practice.

Two `real-life' cases will be discussed and students will get a group assignment in which the cases will have to be analyzed and certain questions will have to be answered. Each group writes a short analysis and subsequently presents this in front of the whole group. Subsequently, each student will engage in a personal assignment as described above. The outputs will consist of a presentation before the whole group. The aim is to provide as real life a setting as is possible.

Form of tuition
A mix of lectures, guest lectures, Pharma sector casework and related assignments. Individual coaching on the business planning excercise. Outputs include report and oral presentations and a final written exam.

Type of assessment
In order to receive 6 credits for this course, the following criteria must be met:
- the written exam must be passed with a grade 6 or more (50% of final grade)
- the assignment must be completed with a written document and short presentation before the group (50% of final grade)

Course reading
Selected scientific publications
Harvard Business Cases as posted on blackboard.
New World Drug Development by R Robert M. Rydzewski 2008
Business Model Generation – Osterwalder 2010

Entry requirements
Completed Bachelor SBI or comparible

Target group
M Chem -SBI or M Physics - SBI

Remarks
In case you have any questions about this course, please contact the coordinator at <p.van.hoorn@vu.nl$gt;

Catalysis for sustainable energy

Course code	X_437027 ()
Period	Period 4
Credits	6.0
Language of tuition	English

Faculty	Faculteit der Exacte Wetenschappen
Level	500

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/20734

Remarks
Course registration at the UVA is compulsory at least 4 weeks before the start of the semester via https://www.sis.uva.nl

Chemical Analysis for Forensic Evidence

Course code	X_437003 (437003)
Period	Period 2
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Teaching method(s)	Lecture
Level	500

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/16929

Remarks
This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.
Enrolment via https://m.sis.uva.nl/vakaanmelden is required.

Chemical Biology

Course code	X_432538 (432538)
Period	Period 1
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	prof. dr. R. Leurs
Examinator	prof. dr. R. Leurs
Teaching staff	prof. dr. R. Leurs
Teaching method(s)	Lecture, Computer lab
Level	400

Course objective
To get students acquainted with modern chemical biology techniques to study proteins and the modulation of their function, with a specific emphasis on drug discovery

Course content
In this course emphasis will be given on the interface between Chemistry and Biology. How can one understand biological processes using small molecules? How can one identify small molecules targeting new

biochemical pathways, either by using modern biochemical or cellular assays (e.g. SPR, FRET, BRET, High-content & High resolution analysis), or in silico using the wealth of new information from structural biology? How to detect and/or modulate DNA, RNA and protein expression and/or function with chemical probes? These are the questions that are central to this course.

Form of tuition
lectures, tutorial, consultancy sessions and case study/presentation

Type of assessment
Students will work in small groups on an integrated case study. Based on primary literature, background information from Comprehensive Medicinal Chemistry, interaction with “Protein Champions”, students will work on a “Chemical Biology Protein Report” and oral presentation. Finally, there will be a written examination at the end of the course on the various topics presented in the course.

Final grades will be based on results of the case study (35%), case presentation and discussion (15%) and final exam (50%). Each part must at least be satisfactory (mark “6 out of 10” or higher).

Course reading
Selected book chapters from Comprehensive Medicinal Chemistry II, 2007, Elsevier, Editors-in-Chief: John B. Taylor and David J. Triggle (available at VU library as e-book) and primary literature.

Entry requirements
Bachelor Pharmaceutical Sciences, Medical Natural Science, Science, Business and Innovation or Chemistry. Portal course MSc Biomolecular Science or Principles of Pharmaceutical Sciences, Signal Transduction in Health and Disease, or equivalent for mBMS students and students with Bsc SBI of Chemistry.

Target group
mBMS-BC, mCh-SBI (2nd year), mDDS-BCCA, mDDS-CMCT, mDDS-DD&S, mDDS-DDSA, mDDS-DDTF,
mDDS-C-var, mDDS-E-var, mDDS-M-var, mPhys-SBI (2nd year)

Registration procedure
Please register as soon as possible online.

Remarks
Presence is obliged at predefined moments of the course (e.g. kick-off meeting, computer practical, presentation session, examination) for finishing the course successfully.

Clinical Development and Clinical Trials

Course code	AM_1180 ()
Period	Period 3
Credits	3.0
Language of tuition	English
Faculty	Fac. der Aard- en Levenswetenschappen
Coordinator	prof. dr. H.J.H.M. Claassen
Examinator	prof. dr. H.J.H.M. Claassen

Teaching method(s)	Lecture, Study Group
Level	500

Course objective
- to gain knowledge and insight into the function of clinical trials
- to gain knowledge and insight into the design of clinical trials
- to gain knowledge and insight into the conduct of clinical trials, including the applying rules and regulations (including ICH-GCP)
- to gain knowledge and insight into and reflect on the roles, tasks and responsibilities of the stakeholders involved in clinical trials
- to reflect on the role of golden standard in our healthcare system
- to learn where and how to look up rules and regulations.

Course content
In today's healthcare system, clinical trials have gained the status of golden standard to test the safety and efficacy of newly developed drugs. For new drugs to enter the market, clinical trials must be passed and as a consequence, clinical trial outcomes have major effects on our healthcare system. While our healthcare system currently is under pressure to remain affordable and available to all, at the same time, clinical trial regulations are increasingly tightened and the prominence of clinical trials in our healthcare system is being criticized. For that matter, it is of great importance to learn about and reflect on the role of clinical trials in today's healthcare system.

The Clinical Development & Clinical Trials course will elaborate on the function, design and conduct of clinical trials, as well as the relevant stakeholders involved. The course consists of a theoretical part and an important practical part (e.g. gaining knowledge on clinical trial regulations). Classes include for example: 'Life Cycle of a Clinical Trial', 'Clinical Trial Methodology', 'ICH-GCP Principles', 'The Ethics Committee', 'Safety Considerations in Clinical Trials', 'Quality Control & Quality Assurance', 'Compliance, Misconduct & Fraud'.

The gained knowledge and skills will be evaluated by means of a written exam at the end of the course.

Form of tuition
Lectures: 35 h.
Self study: remaining hours

Type of assessment
Written exam: 100%.

Course reading
Will be announced on Blackboard 1 month before the start of the course.

Target group
Optional course for Master students Management, Policy Analysis and Entrepreneurship in Health and Life Sciences (MPA), Societal differentiation of the Health, Life & Natural Sciences.

Remarks
Guest lecturers/organisations:
• Eric Klaver
• DOCS
• Others to be announced.

Colloquium and Literature Thesis

Course code	X_432578 (432578)
Period	Ac. Year (September)
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	prof. dr. ir. R.V.A. Orru
Examinator	prof. dr. ir. R.V.A. Orru
Level	600

Course objective
please contact the mastercoordinator of your track

Colloquium and Literature Thesis

Course code	X_432579 (432579)
Period	Ac. Year (September)
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	prof. dr. ir. R.V.A. Orru
Examinator	prof. dr. ir. R.V.A. Orru
Level	600

Course objective
please contact the mastercoordinator of your track

Colloquium and Literature Thesis

Course code	X_432581 (432581)
Period	Ac. Year (September)
Credits	12.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. H. Lingeman
Examinator	dr. H. Lingeman
Level	600

Course objective
Literature study on a topic related to biomolecular analysis.

Course content
The topic will be chosen in close cooperation and with approval of the master coordinator.

Form of tuition

Selfstudy and discussion sessions.

Type of assessment
Report and presentation.

Target group
mCh-AS

Colloquium and Literature Thesis

Course code	X_432679 (432679)
Period	Ac. Year (September)
Credits	12.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. C. Fonseca Guerra
Examinator	dr. C. Fonseca Guerra
Level	600

Remarks
Period: variable
Contact master coordinator: C.FonsecaGuerra@vu.nl

Colloquium and Literature Thesis

Course code	X_432580 (432580)
Period	Ac. Year (September)
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	prof. dr. ir. R.V.A. Orru
Examinator	prof. dr. ir. R.V.A. Orru
Level	600

Course objective
please contact the mastercoordinator of your track

Communication, Organization and Management

Course code	AM_470572 ()
Period	Period 2
Credits	6.0
Language of tuition	English
Faculty	Fac. der Aard- en Levenswetenschappen
Coordinator	M.J. Kishna
Examinator	M.J. Kishna
Teaching staff	dr. H. Wels, prof. dr. F. Scheele, dr. M.B.M. Zweekhorst
Teaching method(s)	Lecture, Study Group
Level	500

Course objective
To get acquainted with theories on organisational behaviour
To obtain a deeper understanding of communication from the perspective of sharing and influencing results
To acquire knowledge on organisational structures and designs
To get acquainted with important theories on organisational transitions and change management
To acquire insight into different management practices in the health and life sciences sector
To gain insight in leadership and interpersonal behaviour
To obtain insight in methods for motivation and conflict management
To improve communication skills
To practise analytical and advisory skills

Course content
Organisations in the health and life science sector are changing fast, a phenomenon driven by newly emerging technologies and increasing societal complexity. A growing number of students with a beta degree will hold professional and managerial functions in these organisations. During this course students will learn how to be effective performers within these environments, both individually and in teams. This requires an understanding of the macro aspects of organisational behaviour, including designing organisations, managerial skills and ways of strategic thinking. Several speakers conduct lecturers on aspects as motivation, managing interpersonal behaviour, leadership, communication and developing and changing organisations. The speakers explain theories from literature and relate them to their practical experiences. In addition, the students interview managers in health organisations and analyse these interviews using the newly acquired theoretical concepts. Also, practical cases of health care companies will be analysed and discussed, resulting in advisory reports for management. With the other students you discuss your experiences and a coach helps you relate the experiences to theory.

Form of tuition
Lectures: approximately 22 hours
Response lectures: 4 hours
Training workshops 12 hours
Self-study and writing project assignment: remaining hours.

Type of assessment
Written exam (60%;) and assessment of the interviews, case study analysis, and reports (40%). Grades of both parts must at least be 6 or higher.

Course reading
To be announced on Blackboard

Target group
Compulsory course within the Master programme Management, Policy Analysis and Entrepreneurship for the Health and Life Sciences (MPA) and the Societal differentiation of Health, Life and Natural Sciences Masters programmes

Remarks
Attendance to training, workshops, interviews and discussions is indispensable

Coordination and Organometallic Chemistry

Course code	X_435664 (435664)
Period	Period 2
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Teaching method(s)	Lecture
Level	400

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/15033

Remarks
This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.
Enrolment via https://m.sis.uva.nl/vakaanmelden is required.

Current Sustainable Energy Technologies

Course code	X_422582 ()
Period	Period 3
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. J.P. Dekker
Examinator	dr. J.P. Dekker
Teaching staff	dr. J.P. Dekker, dr. R.N. Frese
Teaching method(s)	Lecture, Seminar
Level	500

Course objective
To obtain a complete overview of the technical, economic and societal feasibilities of all possible forms of sustainable energy, including relevance and positive and negative effects. The students should be able to explain the basic features of these technologies and should also be able to make quantitative predictions for each of these technologies.

Course content
In week 1, students read all chapters of the book and formulate for each chapter a technological and/or economic/societal question. The question will be accompanied with hypothetical answers or estimations or working hypotheses. Answers must be as quantitative as possible. In week 2, students will present and discuss their questions and hypotheses with their group. Then, participants will be handed specific assignments for further research. In week 3, students will present the results of their further research, and will receive feedback from the other participants in their group. In week 4, students will give their final presentations to all participants of the course and will hand in the final report of their work.

Form of tuition
Introductory lecture in week 1, five discussion meetings in weeks 1, 2 and 3 in groups of about 10 students, final meeting with all participants in week 4 in which students present their most important worked-out question.

Type of assessment
Initial questions, hypothetical answers and participation in the discussion result in 50% of the grade. The final document constitutes also 50% of the grade. All documents will be graded by two independent lecturers, their marks will be averaged. Both parts need to have a mark of 6.0 or higher.

Course reading
David J.C. Mackay (2008) Sustainable energy – without the hot air, available free online at http://www.withouthotair.com

Entry requirements
Basic knowledge of thermodynamics and sustainable energy

Target group
mCh-SBI, mPhys-SBI, mCh-SES, mPhys-SES

Density Functional Theory for Chemists

Course code	X_435111 (435111)
Period	Ac. Year (September)
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	prof. dr. F.M. Bickelhaupt
Examinator	prof. dr. F.M. Bickelhaupt
Level	500

Course objective
Understanding basic concepts of Density Functional Theory (DFT), in particular, Kohn-Sham DFT, and its application to understanding and predicting chemical bonding, molecular structure, and reactivity.

Course content
Electron density, Hole functions, Electron density as basic variable instead of the wavefunction, Hohenberg-Kohn theorems, Kohn-Sham approach, Approximate exchange-correlation functionals, Basic machinery of DFT computer programs.

Form of tuition
Independent study

Type of assessment
Oral exam

Course reading
Parts of: (a) W. Koch en M. C. Holthausen, A Chemist's Guide to Density Functional Theory; Sec. Ed.; Wiley-VCH Verlag: Weinheim, 2000.; (b) F.M.

Bickelhaupt, E.J. Baerends, Kohn-Sham Density Functional Theory: Predicting and Understanding Chemistry, in: Rev. Comput. Chem.; K.B. Lipkowitz, D.B. Boyd, Eds.; Wiley-VCH: New York, Vol. 15.

Remarks
Period: in consultation with the lecturer

Density Functional Theory for Chemists

Course code	X_435112 (435112)
Period	Ac. Year (September)
Credits	12.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	prof. dr. F.M. Bickelhaupt
Examinator	prof. dr. F.M. Bickelhaupt
Level	500

Course objective
Understanding basic concepts of Density Functional Theory (DFT), in particular, Kohn-Sham DFT, and its application to understanding and predicting chemical bonding, molecular structure, and reactivity.

Course content
Part I (6 ECTS): Electron density, Hole functions, Electron density as basic variable instead of the wavefunction, Hohenberg-Kohn theorems, Kohn-Sham approach, Approximate exchange-correlation functionals, Basic machinery of DFT computer programs. Part II (6 ECTS): Molecular structure, Vibrational frequencies, Thermochemistry, Hydrogen bonds, Kohn-Sham molecular orbital (MO) model of the electronic structure and chemical bond, Chemical reactivity.

Form of tuition
zelfstudie

Type of assessment
Oral examination.

Course reading
Parts of: (a) W. Koch en M. C. Holthausen, A Chemist's Guide to Density Functional Theory; Sec. Ed.; Wiley-VCH Verlag: Weinheim, 2000.; (b) F.M. Bickelhaupt, E.J. Baerends, Kohn-Sham Density Functional Theory: Predicting and Understanding Chemistry, in: Rev. Comput. Chem.; K.B. Lipkowitz, D.B. Boyd, Eds.; Wiley-VCH: New York, Vol. 15; (c) Other selected tutorial reviews (in consultation).

Target group
mCh, mPhar

Remarks
Period: in consultation with the lecturer

Didactiek 1

Course code	O_MLDIDAC_1 ()

Period	Period 1, Period 4
Credits	6.0
Language of tuition	Dutch
Faculty	Fac. der Gedrags- en Bewegingswetensch.
Coordinator	C.L. Geraedts
Examinator	dr. A. Handelzalts
Teaching staff	drs. J.K.W. Riksen, drs. H.R. Goudsmit, drs. Y.G. Meindersma, ir. E.J.F. Scheringa, drs. W.S. Hoekstra, drs. C.D.P. van Oeveren, drs. S. Donszelmann, drs. B. Klein, drs. W. Jongejan, drs. L.J. van Well-van Grootheest, dr. H.B. Westbroek, C.L. Geraedts, drs. A. Krijgsman, dr. A.A. Kaal, dr. A. Handelzalts, drs. K.L. Schaap, W. Maas, F.L. de Vries MSc, drs. H. Stouthart, drs. I. Pauw
Teaching method(s)	Lecture, Study Group
Level	400

Didactiek 2

Course code	O_MLDIDAC_2 ()
Period	Period 2+3, Period 5+6
Credits	6.0
Language of tuition	Dutch
Faculty	Fac. der Gedrags- en Bewegingswetensch.
Coordinator	drs. B. Klein
Examinator	dr. A. Handelzalts
Teaching staff	drs. J.K.W. Riksen, drs. H.R. Goudsmit, drs. Y.G. Meindersma, ir. E.J.F. Scheringa, drs. W.S. Hoekstra, drs. C.D.P. van Oeveren, drs. S. Donszelmann, drs. B. Klein, drs. W. Jongejan, drs. L.J. van Well-van Grootheest, dr. H.B. Westbroek, C.L. Geraedts, drs. A. Krijgsman, dr. A.A. Kaal, dr. A. Handelzalts, drs. K.L. Schaap, W. Maas, F.L. de Vries MSc, drs. H. Stouthart, drs. I. Pauw
Teaching method(s)	Study Group, Lecture
Level	400

Didactiek 3

Course code	O_MLDIDAC_3 ()
Period	Period 4+5+6
Credits	9.0
Language of tuition	Dutch
Faculty	Fac. der Gedrags- en Bewegingswetensch.
Coordinator	drs. K.L. Schaap
Examinator	drs. K.L. Schaap

Teaching staff	drs. J.K.W. Riksen, drs. H.R. Goudsmit, drs. Y.G. Meindersma, ir. E.J.F. Scheringa, drs. W.S. Hoekstra, drs. C.D.P. van Oeveren, drs. S. Donszelmann, drs. B. Klein, drs. W. Jongejan, drs. L.J. van Well-van Grootheest, dr. H.B. Westbroek, C.L. Geraedts, drs. A. Krijgsman, dr. A.A. Kaal, dr. A. Handelzalts, drs. K.L. Schaap, W. Maas, F.L. de Vries MSc, drs. H. Stouthart, drs. I. Pauw
Teaching method(s)	Lecture, Study Group
Level	400

Disability and Development

Course code	AM_470588 ()
Period	Period 2
Credits	6.0
Language of tuition	English
Faculty	Fac. der Aard- en Levenswetenschappen
Coordinator	dr. R.M.H. Peters
Examinator	dr. R.M.H. Peters
Teaching method(s)	Lecture, Study Group
Level	500

Course objective
• To develop an understanding of disability and the issues faced by people with disabilities
• To develop knowledge and skills for disability research, policy development and management related to disability, rehabilitation and development
• To acquire insight into the epidemiology of disability, with separate attention for important determinants like gender, poverty and HIV/AIDS
• To learn how to use relevant models of disability and the conceptual framework of the International Classification of Functioning, Disability and Health (ICF)
• To understand the importance of human rights in relation to disability and to learn to use the UN Convention for the Rights of Persons with Disabilities for advocacy and other rights-based interventions
• To acquire skills and knowledge in measurement and research methods relevant to disability
• To understand the importance of inter-sectoral collaboration
• To gain insight in participatory approaches

Course content
The Disability and Development (D&D) course focuses on a broad range of issues related to disability and rehabilitation in the context of development. This means that the focus is on people with disabilities in low and middle-income countries. Disability affects an estimated 1 billion people worldwide, the majority of whom live in low and middle-income countries. The large majority are poor and have no access to rehabilitation services; neither are facilities in place to allow them to be included in the mainstream of society.

To date, very few services and programmes are available to address these needs. The realisation that the Millennium Development Goals cannot be met without addressing the needs of people with disability has brought a new impetus to the field of disability and development. Another major recent development was the adoption of the UN Convention on the Rights of Persons with Disabilities in December 2006. It is expected that there will be a substantial increase in demand for training of a large variety of professionals (e.g. researchers, managers, architects, lawyers, health professionals) with formal training and qualifications in the field of disability-inclusive development.

This rapidly increasing interest in disability, as a development and human rights issue, means that this emerging field of study will rapidly gain in importance and should become part of any serious higher education programme in social and development studies and in international public health. The course will cover essential knowledge and skills in this subject.

The 4-week course programme will include the following subjects:
• Disability models and stereotypes,
• Frequencies and distribution of disability,
• Experience of having a disability,
• ICF conceptual framework,
• Disability rights, including the UN Convention on the Rights of Persons with Disabilities,
• Culture and disability,
• Determinants of disability, including stigma and discrimination, poverty, gender and HIV/AIDS,
• Disability-relevant research methods, including examples of disability research
• An introduction to community-based rehabilitation and disability inclusive development.

Form of tuition
Problem-based learning supported by lectures and an article writing assignment.

• Lectures: 36 hours
• Tutorial groups: 18 hours
• Other events: 12 hours
• Self-study: remaining hours

Type of assessment
Participation in tutorial groups: 10%
Take-home examination, submitted electronically: 60%
Scientific article/essay: 30%

For all parts a pass grade (> 5.5) needs to be obtained in order to receive a final mark.

Course reading
See e-reader

Entry requirements
Bachelor-level education; any subject

Target group

The Disability & Development module is an optional course for Master students Management, Policy Analysis and Entrepreneurship in Health and Life Sciences (MPA), International Public Health and Biomedical Sciences; external students from low and middle-income countries are strongly encouraged to apply. We encourage the participation of students with disabilities, especially from low and middle-income countries.

Remarks
For more information contact Ruth Peters (r.m.h.peters@vu.nl)

Educational and Pedagogical Studies I

Course code	O_MLADEPI ()
Period	Period 1+2
Credits	6.0
Language of tuition	Dutch
Faculty	Fac. der Gedrags- en Bewegingswetensch.
Coordinator	dr. A. Handelzalts
Examinator	dr. A. Handelzalts
Teaching staff	drs. J.K.W. Riksen, drs. H.R. Goudsmit, drs. Y.G. Meindersma, drs. W.S. Hoekstra, drs. C.D.P. van Oeveren, drs. S. Donszelmann, drs. B. Klein, drs. W. Jongejan, dr. H.B. Westbroek, C.L. Geraedts, drs. A. Krijgsman, dr. A.A. Kaal, drs. K.L. Schaap, W. Maas, F.L. de Vries MSc, drs. H. Stouthart, drs. I. Pauw
Teaching method(s)	Lecture
Level	500

Educational and Pedagogical Studies II

Course code	O_MLADEPII ()
Period	Period 1+2
Credits	3.0
Faculty	Fac. der Gedrags- en Bewegingswetensch.
Coordinator	dr. A. Handelzalts
Examinator	dr. A. Handelzalts
Teaching staff	drs. J.K.W. Riksen, drs. H.R. Goudsmit, drs. Y.G. Meindersma, drs. W.S. Hoekstra, drs. C.D.P. van Oeveren, drs. S. Donszelmann, drs. B. Klein, dr. T. Bosma, dr. H.B. Westbroek, C.L. Geraedts, drs. A. Krijgsman, dr. A.A. Kaal, drs. K.L. Schaap, W. Maas, F.L. de Vries MSc, drs. H. Stouthart, drs. I. Pauw
Teaching method(s)	Lecture, Seminar
Level	500

Emergent Energy Materials

Course code	X_428571 ()
Period	Period 1

Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Level	400

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/1132205

Registration procedure
Registration is required via https://www.sis.uva.nl during the registration term before the start of the semester.

Remarks
This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.
Enrolment via https://m.sis.uva.nl/vakaanmelden is required.

Energy and Climate Change; Science, Policy and Economics

Course code	X_428568 ()
Period	Period 2
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Level	400

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/17937

Remarks
This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.
Enrolment via https://m.sis.uva.nl/vakaanmelden is required.

English Academic Course

Course code	X_437028 ()
Period	Period 2+3, Period 5+6
Credits	3.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Level	400

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/20616

Target group
mCh, mPhys

Remarks
Course registration at the UVA is compulsory at least 4 weeks before the start of the semester via https://www.sis.uva.nl

Entrepreneurship in Health and Life Sc.

Course code	AM_470575 ()
Period	Period 2
Credits	6.0
Language of tuition	English
Faculty	Fac. der Aard- en Levenswetenschappen
Coordinator	prof. dr. E. Masurel
Examinator	prof. dr. E. Masurel
Teaching staff	prof. dr. E. Masurel
Teaching method(s)	Lecture, Study Group
Level	500

Course objective
Students obtain knowledge about and insight in the relevance of entrepreneurship and innovation for their own discipline. Students learn about the processes which are involved in the recognition and exploitation of opportunities, about creating economic and social value and about the nature and role of networks. In addition students gain knowledge of different entrepreneurial processes and the importance of valorisation of (bio)medical findings and business ideas for a knowledge-based economy.
Learning objectives

- Become familiar with an innovation outlook on entrepreneurship.
- Become aware that value-adding opportunities not only contain financial aspects but also social and ecological aspects (sustainable entrepreneurship).
- Gain the ability to write a feasibility plan on how to bring an innovation to the market.
- Obtain knowledge about and insight in the relevance of entrepreneurship and innovation for science disciplines.
- Learn about the processes which are involved in the recognition and exploitation of opportunities, about creating economic and social value and about the nature and role of networks.
- Gain knowledge of different entrepreneurial processes and the importance of valorisation of (bio)medical findings and business ideas for a knowledge-based economy.

Course content
This course consists of two tracks: a theoretical track and a practical track. These two tracks run simultaneously. In the first track you learn about entrepreneurship. Answers are found on questions such as: What is entrepreneurship? What defines an entrepreneur? What are entrepreneurial opportunities? What is the role of innovation in entrepreneurship? What is corporate social responsibility (CSR)? How can we judge the feasibility of entrepreneurial ambitions? Simultaneously you work on an assignment (second track). In the first week of this course you search for an innovation in your own discipline (product, service, process etc). Your choice must be approved by the lecturers. The first part of the assignment consists of a description of the innovation which you

have chosen. Subsequently, you make a SWOT-analysis and a network analysis of the innovation. Also a paragraph on CSR aspect should be added. The final part of the assignment is your own feasibility study: how would you valorize the innovation to the market?

Form of tuition
Lectures, personal meetings. Each week scientific lectures are given (on entrepreneurship, SWOT-analysis, innovation, CSR etc). These lectures are both the basis for the exam and for the assignment. Each week the student has a short meeting with his / her supervisor, in order to discuss the progress of his/her assignment.

Schedule and study time
The total study time is 160 hours.
Tuition methods include lectures, consultancies and self-study.
The different elements have the following study time:
- lectures 18 hours
- consultancies 8 hours
- writing feasibility plan 65 hours
- examination 4 hours
- self study remaining hours

Type of assessment
You conduct a written exam and an assignment. Both the exam and the assignment determine 50% of the grade. The exam and the assignment must be of sufficient quality.

Course reading
To be announced on Blackboard

Target group
Optional course for Master students Management, Policy Analysis and Entrepreneurship in Health and Life sciences (MPA), M-differentiation of the Health, Life & Natural Sciences, Biology, Biomedical Sciences.

Remarks
Attendance is compulsory. Prior knowledge: Business Management in Health and Life sciences.

Environmental Chemistry

Course code	X_437004 (437004)
Period	Period 1
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Level	400

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/21184

Remarks
This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.
Enrolment via https://m.sis.uva.nl/vakaanmelden is required.

Environmental Measuring Techniques

Course code	AMU_0005 ()
Period	Ac. Year (September)
Credits	6.0
Language of tuition	English
Faculty	Fac. der Aard- en Levenswetenschappen

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/7903

Registration procedure
This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.
Enrolment via https://m.sis.uva.nl/vakaanmelden is required.

Epidemiology

Course code	AM_1179 ()
Period	Period 3
Credits	3.0
Language of tuition	English
Faculty	Fac. der Aard- en Levenswetenschappen
Coordinator	dr. R.M.H. Peters
Examinator	dr. R.M.H. Peters
Teaching method(s)	Lecture, Study Group, Computer lab
Level	500

Course objective
• To gain an understanding of the principles of different study designs
• To gain an understanding of issues concerning measures of disease and association
• To gain an understanding of principles of bias and confounding
• To gain an understanding of the principles of screening and critically appraise its use in public health
• To learn how to calculate and interpret sensitivity, specificity, positive and negative predictive values
• To acquire skills to perform statistical analyses using a database (during the computer-based sessions) and interpret, describe and present the results critically

Course content
This two week course will help you to obtain an understanding of the principles of study designs (cross-sectional, longitudinal, case-control, clinical trails). Issues concerning exposure and disease measurement and exposure-disease relationships will be discussed in detail, and examples will be provided. Together with your colleagues, you will learn how to apply this knowledge first by hand (during the lectures), then to an epidemiologic database (during the computer-based sessions) and how to interpret the results critically.

Form of tuition
• Lectures (12 hours)
• Work groups (12 hours)
• Computer practicum (12 hours)
• Self-study (remaining time)

Type of assessment
• Exam
• Assignment
Both elements need to be passed.

Course reading
To be announced

Target group
Students without a background in epidemiology

Registration procedure
n/a

Remarks
Maximum 25 students

For more information contact Ruth Peters (r.m.h.peters@vu.nl)

Fundamentals of Analytical Sciences

Course code	X_435059 (435059)
Period	Period 4
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Teaching method(s)	Lecture
Level	400

Course objective
To give insight in the procedures used in analytical chemistry, from sampling strategies to method validation and statistical approaches required for data interpretation.

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/15050

Form of tuition
Lectures, workgroups and PC-use sessions.

Type of assessment
Written examination.

Course reading
Hands-outs (electronically available) and course syllabus.

Entry requirements
Basic knowledge of analytical chemistry.

Remarks
This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.
Enrolment via https://m.sis.uva.nl/vakaanmelden is required.

Green Chemistry

Course code	X_430557 (430557)
Period	Period 1
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. J.C. Slootweg
Examinator	dr. J.C. Slootweg
Teaching method(s)	Lecture
Level	400

Course objective
Acquiring knowledge of the general ideas of green chemistry and their importance in the development of sustainable chemical technology.

Course content
Sustainability and green chemistry focuses on 12 principles. Aspects like atom efficiency, chemical waste and manufacturing processes will be highlighted as well as catalysis, solvents, biomass, solar energy, alternative feedstock, energy consumption, and safety, all in the context of chemical sustainability. Important ingredients in the course are student presentations on these topics, and assignments on selected topics.

Form of tuition
Lectures, Group/Individual Assignments and Presentations

Type of assessment
Written/oral examination, assignments

Course reading
Various e-books (VU license) will be used, such as:
-Handbook of Green Chemistry, part 7: Green Synthesis,
http://onlinelibrary.wiley.com/book/10.1002/9783527628698/toc
-Green Chemistry and Engineering: A Pathway to Sustainability,
http://onlinelibrary.wiley.com/book/10.1002/9781118720011
-Sustainable Industrial Chemistry,
http://onlinelibrary.wiley.com/book/10.1002/9783527629114
-Management Principles of Sustainable Industrial Chemistry,
http://onlinelibrary.wiley.com/book/10.1002/9783527649488t.

Target group
mCh-SBI, mPhys-SBI, mCh-SES, mPhys-SES

Health, Globalisation and Human Rights

Course code	AM_470818 ()
Period	Period 2
Credits	6.0
Language of tuition	English
Faculty	Fac. der Aard- en Levenswetenschappen
Coordinator	A. van Luijn MSc
Examinator	dr. C.W.M. Dedding
Teaching staff	prof. dr. P. Heutink
Teaching method(s)	Lecture, Study Group
Level	500

Course objective
The student;

- Is able to describe, understand and apply human rights concepts in a global context
- Develops a deeper understanding and A critical attitude towards scientific literature in the field of health, globalization and human rights in order to formulate soundly argued positions
- Is able to create his/her own vision with regard to the socio-cultural dimensions of human rights values in relation to public health
- Is able to apply methods of human rights assessment in relation to innovations in health care
- Demonstrates the ability to write and present according to academic standards

Course content
This course focuses on the human rights issues that are raised around the globe in connection with public health concerns. The course introduces the students to the effects of globalization on health issues, to the relevant UN human rights instruments on health and to the mechanisms to promote and protect these rights. Attention is given to a wide range of human rights topics in which health and well being play a crucial role. Examples are situations of armed conflict, reproductive rights, migration and refugee issues and childrens rights. Within the context of current globalisation processes the importance of local cultural insights into the human rights & public health interaction will be discussed. During the course students will prepare and participate in a simulation on a human rights assessment of innovations in health technology and discuss relevant scientific literature in study groups. In the exam students will show their creative problem-solving skills applying them to human rights dilemmas in public health.

Form of tuition
Contact hours

Lectures: 33 hours
Work groups: 12 hours
Group project, simulation and exam: 11 hours

Self study and preparing: remaining hours

Type of assessment

Group project (10%), Simulation (20%), exam (70%). All parts need to be passed (6.0)

Course reading
To be announced at the start of the first work group/lecture

Target group
Optional course for students in all differentiations of the Masters Health Sciences, Biomedical Sciences and Management, Policy Analysis and Entrepreneurship in Health and Life Sciences.

Remarks
(Guest) Lectures and guest organisations (under reservation):
Cees Hamelink
Christine Dedding (Children and rights)
Fiona Budge (Culture and Health)
Bert Keizer (Elderly Rights)
Els Mons (Rights and disabled persons)
Women on Waves
Doctors without Borders
And more to be announced.

For more information contact Wanda Konijn (w.s.konijn@vu.nl) or Anna van Luijn (a.van.luijn@vu.nl)

Heterogeneous Catalysis

Course code	X_428013 ()
Period	Period 3
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Level	400

Course objective
http://studiegids.uva.nl/xmlpages/page/2014-2015/zoek-vak/vak/14343

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/21097

Remarks
This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.
Enrolment via https://m.sis.uva.nl/vakaanmelden is required.

High-Throughput Screening

Course code	X_435047 (435047)
Period	Period 2
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. J. Kool

Examinator	dr. J. Kool
Teaching staff	dr. J. Kool
Teaching method(s)	Lecture
Level	500

Course objective
In depth study on the bio-analytical and screening aspects related to target and lead discovery of drugs.

Course content
During this course the potential of modern analytical and biological screening techniques used in target, hit and lead discovery will be discussed. The emphasis will be on the treatment of advanced sample preparation techniques (i.e. automation, high-throughput / combinatorial chemistry, miniaturization), biological and immunological high throughput screening assays and advanced separation methods. Also, the so called "Omics" will be discussed (e.g. proteomics and metabolomics). These techniques will be discussed in relation with pharmacokinetic studies and the applicability of the various techniques within the various stages of target discovery, hit screening, ADME(tox), and early lead discovery. Finally, miniaturization approaches will be dealt with.

Form of tuition
The course starts with a thorough explanation on all subjects that will be discussed, and during which lecture. During the lectures, relevant literature per lecture will be mentioned. This literature is mainly from e-books (chapters) and from academic papers/reviews. All literature that will be mentioned can be found in the course documents on BlackBoard. All this literature has to be studied for the oral examination. All students will work on an assignment related to a topic in high throughput screening. This assignment results in a document and a PowerPoint presentation of 8 minutes.

Type of assessment
Examination is in the form of an oral or written examination accounting for 50% of the final mark (depending on the number of students entering the course). All lectures and all literature provided are included in the examination. All material to be studied and learned for the examination can be accessed during the examination. Students can take all printed material and/or a computer with them during the examination. De presentation of 8 minutes followed by questions and replies to these questions constitutes 25% of the final mark. The Document’s topic and the presentation’s topic are related to each other. The document is between 6 and 8 pages (Times New Roman type 12; line spacing 1) including title page and with a maximum of 4 Figures/Tables. The assignment document constitutes the other 25% of the final mark. The marks of the examination, the presentation and discussion afterwards, and the assignment document all have to be sufficient (6.0).
(If more than 12 students join this course, students will form groups of two students. In that case, the presentations will be given by both students per group and each presentation has a duration of 12 minutes. The document is then between 10 and 14 pages (Times New Roman type 12; line spacing 1) including title page and with a maximum of 6 Figures/Tables. The oral examination will then still be on individual basis).

Course reading
Please see the Course Documents on BlackBoard. The PowerPoint presentation named "HTS Course Overview" gives a detailed explanation/overview of the lectures, tutorials and course structure. All PowerPoint lectures will be placed on BlackBoard at least one day before each lecture. All PDF e-book chapters and other literature (e.g. academic research papers and reviews) can already be found on BlackBoard. It will be announced when each PDF literature is/are to be read in order to prepare for a respective lecture.

Recommended background knowledge
Basic knowledge of biochemistry, separation sciences, spectroscopy and mass spectrometry.

Target group
mCh-AS, mCh-MDSC, mDDS-BCCA, mDDS-DDTF

Homogeneous Catalysis

Course code	X_435668 (435668)
Period	Period 5
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Teaching method(s)	Lecture
Level	400

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/15031

Remarks
This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.
Enrolment via https://m.sis.uva.nl/vakaanmelden is required.

Innovation in Medical Technology to Improve the Health Care System

Course code	X_430602 ()
Period	Period 6
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. ir. T.J.C. Faes
Examinator	dr. ir. T.J.C. Faes
Teaching staff	dr. ir. T.J.C. Faes
Teaching method(s)	Lecture, Seminar
Level	500

Course objective
In innovative development of medical devices the Dutch Health Care System is the natural environment where medical devices need to

demonstrate their quality. The aim of the course is to acquire knowledge of the Dutch Health Care System from the perspective of medical devices.

Course content
To be successful in innovation of medical devices one needs knowledge of the 1) Dutch Health Care System, 2) use and users of medical devices, 3) standards and legislation for medical devices, 4) measures of quality of medical devices, and 5) best practice in assurance of quality and safety of medical devices.

Form of tuition
Lectures and working groups.

Type of assessment
Short written report & oral presentation on a specific medical device.

Course reading
Reader

Internship Biomolecular Analysis and Spectroscopy

Course code	X_432523 (432523)
Period	Ac. Year (September)
Credits	18.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. H. Lingeman
Examinator	dr. H. Lingeman
Level	500

Course objective
To acquire knowledge and insight into the role and objective of drug, bio-analytical and clinical development processes in complex samples using LC-MS and bio-assay-MS based approaches.

Course content
This project aims to provide the student with a theoretical and practical understanding of the issues involved in the design, conduct, analyses and interpretation of complex analytical studies.

Target group
mCh

Remarks
For further information please contact Henk Lingeman.

Internship Biomolecular Analysis and Spectroscopy

Course code	X_432524 (432524)
Period	Ac. Year (September)
Credits	24.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen

Coordinator	dr. H. Lingeman
Examinator	dr. H. Lingeman
Level	500

Course objective
To acquire knowledge and insight into the role and objective of drug, bio-analytical and clinical development processes in complex sample using LC-MS and bio-assay-MS based approaches.

Course content
This project aims to provide the student with a theoretical and pracical understanding of the issues involved in the design, conduct, analyses and interpretation of complex analytical studies.

Target group
mCh

Remarks
For further information please contact Henk Lingeman.

Internship Biomolecular Analysis and Spectroscopy

Course code	X_432525 (432525)
Period	Ac. Year (September)
Credits	30.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. H. Lingeman
Examinator	dr. H. Lingeman
Level	500

Course objective
To acquire knowledge and insight into the role and objective of drug, bio-analytical and clinical development processes in complex samples using LC-MS and bio-assay-MS based approaches.

Course content
This project aims to provide the student with a theoretical and practical understanding of the issues involved in the design, conduct, analyses and interpretation of complex analytical studies.

Target group
mCh

Remarks
For furher information please contact Henk Lingeman.

Internship Organic Chemistry

Course code	X_432529 (432529)
Period	Ac. Year (September)
Credits	18.0
Language of tuition	English

Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. J.C. Slootweg
Examinator	dr. J.C. Slootweg
Level	500

Course objective
To obtain experience in doing scientific research in an industrial setting.

Course content
During a traineeship, a student actively participates in a research project within a company

Type of assessment
presentation, report and practical work

Remarks
Period: varible

Internship Organic Chemistry

Course code	X_432530 (432530)
Period	Ac. Year (September)
Credits	24.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. J.C. Slootweg
Examinator	dr. J.C. Slootweg
Level	500

Course objective
To obtain experience in doing scientific research in an industrial setting.

Course content
during a traineeship, a student actively participates in a research project within a company

Type of assessment
presentation, report and practical work

Remarks
Period: variable

Internship Organic Chemistry

Course code	X_432531 (432531)
Period	Ac. Year (September)
Credits	30.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. J.C. Slootweg

Examinator	dr. J.C. Slootweg
Level	500

Course objective
during a traineeship, a student actively participates in a research project within a company

Course content
during a traineeship, a student actively participates in a research project within a company

Type of assessment
presentation, report and practical work

Remarks
Period: variable

Internship Societal Specialisation

Course code	AM_471147 ()
Period	Ac. Year (September)
Credits	30.0
Language of tuition	English
Faculty	Fac. der Aard- en Levenswetenschappen
Coordinator	dr. R.J. van Belle-van den Berg
Examinator	dr. R.J. van Belle-van den Berg
Level	600

Internship Theoretical Chemistry

Course code	X_432532 (432532)
Period	Ac. Year (September)
Credits	18.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. C. Fonseca Guerra
Examinator	dr. C. Fonseca Guerra
Level	500

Course objective
To obtain experience in theoretical and computational chemistry techniques and doing scientific research.

Type of assessment
presentation, report, practical work

Target group
MSP and MDSC track

Remarks

Period: variable

Internship Theoretical Chemistry

Course code	X_432533 (432533)
Period	Ac. Year (September)
Credits	24.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. C. Fonseca Guerra
Examinator	dr. C. Fonseca Guerra
Level	500

Course objective
To obtain experience in theoretical chemistry and computational techniques and doing scientific research.

Type of assessment
presentation, report and practical work

Remarks
Period: variable

Internship Theoretical Chemistry

Course code	X_432534 (432534)
Period	Ac. Year (September)
Credits	30.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. C. Fonseca Guerra
Examinator	dr. C. Fonseca Guerra
Level	500

Course objective
To obtain experience in theoretical and computational chemistry techniques and doing scientific research.

Type of assessment
presentation, report, practical work

Remarks
Period: variable

Lasers and Quantum Optics

Course code	X_422539 (422539)
Period	Period 1
Credits	6.0
Language of tuition	English

Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. H.L. Bethlem
Examinator	dr. H.L. Bethlem
Teaching staff	dr. W. Vassen, dr. H.L. Bethlem
Teaching method(s)	Lecture, Seminar
Level	400

Course objective
To provide insight into the theory of light, light-matter interactions and lasers.

Course content
- Classical Optics (Maxwell's equations, diffraction and interference)
- Nonlinear Optics
- First- and second order coherence
- Radiative transitions in atoms, Einstein coefficients, transition rates, width of spectral lines
- Lasers
- Photon statistics, shot noise
- Photon antibunching
- Coherent states
- Photon number states
- Atom-photon interactions; density matrix, Rabi oscillations, Bloch sphere
- Laser cooling and trapping

Form of tuition
Lectures, exercises.

Type of assessment
Written exam.

Course reading
Mark Fox, Quantum Optics (Oxford university Press 2006).

Target group
mMNS-PoL, mPhys-PLH, mCh-MSP

Literature Thesis and Colloquium Chemistry - Organic Chemistry

Course code	X_432583 (432583)
Period	Ac. Year (September)
Credits	12.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. J.C. Slootweg
Examinator	dr. J.C. Slootweg
Level	600

Course content
the student can choose from a wide variety of topics in main group chemistry, organometallic chemistry and catalysis

Type of assessment
report and presentation

Target group
mCH-MDSC

Literature Thesis and Colloquium Chemistry - Physical Chemistry

Course code	X_432582 (432582)
Period	Ac. Year (September)
Credits	12.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. C. Fonseca Guerra
Examinator	dr. C. Fonseca Guerra
Level	600

Remarks
Contact master coordinator: C.FonsecaGuerra@vu.nl

Literature Thesis and Colloquium Chemistry - Theoretical Chemistry

Course code	X_432584 (432584)
Period	Ac. Year (September)
Credits	12.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. C. Fonseca Guerra
Examinator	dr. C. Fonseca Guerra
Level	600

Remarks
Contact master coordinator: C.FonsecaGuerra@vu.nl

Literature Thesis SES

Course code	X_432785 ()
Period	Ac. Year (September)
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. J.C. Slootweg
Examinator	dr. J.C. Slootweg
Level	600

Type of assessment
report and presentation

Target group
mCH-SES, mPhys-SES

Management of Sustainable Innovation

Course code	X_432739 ()
Period	Period 2
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. R.J.A. Klein Woolthuis
Examinator	dr. R.J.A. Klein Woolthuis
Teaching staff	dr. R.J.A. Klein Woolthuis
Teaching method(s)	Lecture, Seminar
Level	400

Course objective
Sustainable innovation is crucial to counter the challenges our societies are facing: energy without CO2 emissions, access to water and food, reliable banks, affordable elderly care, climate resilient cities. All fields require a structural rethink of existing systems, and introduction of new products, services, and structures to make a sustainable future possible.

This course has the objective to:
1. Learn to conceive sustainable business innovations that create shared value: cars without emissions, houses that produce their own energy, technologies that make clean drinking water for the poor.
2. Increase understanding of how companies, public and government are interrelated in making these innovations a success
3. Show the ability to 'connect the dots' between environmental, social and economic challenges and concrete business opportunities.

This last learning goal has to be made explicit in the assignment: Making a business pitch of a sustainable innovation to a professional Dragon's Den.

For the course much use will be made of film and documentaries. The business pitch will also have to be made as a you-tube film. The best pitches will be selected through voting on-line, and presented to the Dragon's Den.

Course content
A paradigm shift is happening at this moment. Where over the past decades firms were focused on creating shareholder value, the creation of ‘shared value’ is now gaining terrain: leading management scholars like Peter Senge and Michael Porter are describing how companies from Nike to Tesco create value by including all stakeholders in their firm’s strategies. New strategies are centered around respect for the environment, employees, and other stakeholders as to create positive self-reinforcing cycles of value creation. This requires fundamentally different management models in which collaboration with a wide array of stakeholders in key.

Sustainability is hence no longer a story of wishful thinking or environmental activists, it is at the core of corporate strategy and decision making. Moreover, growth in sustainable markets as renewable energy, organic food, and e.g. fair trade products is double digit year after year. Sustainability is not a fashion or an attempt of firms to 'look good', empirical evidence suggest that proper sustainability management improves firm performance and creates new entrepreneurial opportunities in rapidly growing markets. One only has to think of the successes of the Body Shop, Ben and Jerry's and Fair Trade coffee and chocolate.

Form of tuition
Thursday week 1-6: Tutorial
Friday week 3,5: Guest lectures
Friday week 2,4: Feedback on assignments
Friday week 6: Dragon's Den for presentation selected Sustainable innovation business pitches.

Sustainable innovation business pitches:
Students write a strategic business plan for a sustainable innovation. Examples could be membranes for water cleaning, solar technologies for developing countries, organic catering services, bicycles for polluted cities in India.

In the assignment students use the literature offered in the course to develop a coherent insight into how they can make this innovation a success. Connecting the dots is key: What are external developments / problems? Which innovation can help solve this? Which stakeholders have a stake in this problem? And how can the interaction between innovation and stakeholders be orchestrated to make the innovation a success?

Type of assessment
The final grade of the course is determined by the assignment and a written exam. To pass the course, students must at least score 5.0 for the assignment and the exam, and score an average of at least 5.5 on average. The assignment (25%) and written exam (75%) determine the end grade

Course reading
Senge, Peter M., Bryan Smith, Nina Kruschwitz, Joe Laur, Sara Schley, 2008, The Necessary Revolution: How Individuals and Organizations Are Working Together to Create a Sustainable World, Doubleday. (or later edition)

Several articles which will be placed on Blackboard.

Recommended background knowledge
Students should have a enthusiastic and entrepreneurial take on sustainability. The course requires the students to work very independently on their business assignment.
This assignment can be seen as a preparation of setting up an own company after graduation or proposing innovative changes in existing organizations.

Target group
mCh-SBI, mCH-SES, mPhys-SBI, mPhys-SES,
Master students Business Administration of the specializations: Entrepreneurship, Human Resource Management, Information and Knowledge Management, Management Consulting, Strategy and Organization and

Transport and Supply Chain Management.

Mass Spectrometry

Course code	X_435604 (435604)
Period	Period 2
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Level	400

Course content
http://studiegids.uva.nl/web/uva/sgs/nl/c/229.html

Remarks
Registration via https://www.sis.uva.nl is mandatory 4 weeks before the start of the Semester.

Master Project SfES

Course code	X_422593 ()
Period	Ac. Year (September)
Credits	30.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Level	600

Master Project SfES

Course code	X_422594 ()
Period	Ac. Year (September)
Credits	36.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. J.T.M. Kennis
Examinator	dr. J.T.M. Kennis
Level	600

Master Project SfES

Course code	X_422595 ()
Period	Ac. Year (September)
Credits	42.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. J.T.M. Kennis
Examinator	dr. J.T.M. Kennis

Level	600

Master Project SfES

Course code	X_422596 ()
Period	Ac. Year (September)
Credits	48.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. J.T.M. Kennis
Examinator	dr. J.T.M. Kennis
Level	600

Master Project SfES

Course code	X_422597 ()
Period	Ac. Year (September)
Credits	54.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. J.T.M. Kennis
Examinator	dr. J.T.M. Kennis
Level	600

Master Research Project Biomol. Analysis and Spectr.

Course code	X_432594 (432594)
Period	Ac. Year (September)
Credits	42.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. H. Lingeman
Examinator	dr. H. Lingeman
Level	600

Course objective
To acquire knowledge and insight into the role and objective of drug, bio-analytical and clinical development processes in complex sample using LC-MS and bio-assay_MS based approaches.

Course content
This project aims to provide the student with a theoretical and practical understanding of the issues involved in the design, conduct, analyses and interpretation of complex analytical studies.

Target group

mCh

Remarks
For further information please contact Henk Lingeman.

Master Research Project Biomol. Analysis and Spectr. ext

Course code	X_432595 (432595)
Period	Ac. Year (September)
Credits	18.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. H. Lingeman
Examinator	dr. H. Lingeman
Level	600

Course objective
To acquire knowledge and insight into the role and objective of drug, bio-analytical and clinical development processes in complex samples using LC-MS and bio-assay-MS based approaches.

Course content
This project aims to provide the student with a theoretical and practical understanding of the issues involved in the design, conduct, analyses and interpretation of complex analytical studies.

Target group
mCh.

Remarks
For further information please contact Henk Lingeman.

Master Research Project Biomol. Analysis and Spectr. ext

Course code	X_432637 (432637)
Period	Ac. Year (September)
Credits	12.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. H. Lingeman
Examinator	dr. H. Lingeman
Level	600

Course objective
To acquire knowledge and insight into the role and objective of drug, bioanalytical and clinical development processes in complex sample using LC-MS and bio-assay-MS based approaches.

Course content
This project aims to provide the student with a theoretical and practical understanding of the issues involved in the design, conduct, analyses and interpretation of complex analytical studies.

Target group
mCh.

Remarks
For further information please contact Henk Lingeman.

Master Research Project Biomol. Analysis and Spectr. ext

Course code	X_432680 (432680)
Period	Ac. Year (September)
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. H. Lingeman
Examinator	dr. H. Lingeman
Level	600

Course objective
To acquire knowledge and insight into the role and objective of drug, bio-analytical and clinical development processes in complex samples using LC-MS and bio-assay-MS base approaches.

Course content
This project aims to provide the student with a theoretical and practical understanding of the issues involved in the design, conduct, analyses and interpretation of complex analytical studies.

Target group
mCh

Remarks
For further information please contact Henk Lingeman.

Master Research Project Chemistry - Organic Chemistry

Course code	X_432598 (432598)
Period	Ac. Year (September)
Credits	42.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. J.C. Slootweg
Examinator	dr. J.C. Slootweg
Level	600

Course objective
To obtain experience in organic chemistry techniques and doing scientific research.

Course content
the student can choose from a wide variety of research projects in main group chemistry, organometallic chemistry and catalysis

Type of assessment
presentation, report, practical work

Target group
mCH-MDSC

Master Research Project Chemistry - Organic Chemistry - Extension

Course code	X_432599 (432599)
Period	Ac. Year (September)
Credits	18.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. J.C. Slootweg
Examinator	dr. J.C. Slootweg
Level	600

Course objective
To obtain experience in organic chemistry techniques and doing scientific research.

Course content
the student can choose from a wide variety of research projects in main group chemistry, organometallic chemistry and catalysis

Type of assessment
presentation, report and practical work

Target group
mCH-MDSC

Master Research Project Chemistry - Organic Chemistry - Extension

Course code	X_432618 (432618)
Period	Ac. Year (September)
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. J.C. Slootweg
Examinator	dr. J.C. Slootweg
Level	600

Master Research Project Chemistry - Organic Chemistry - Extension

Course code	X_432685 (432685)
Period	Ac. Year (September)
Credits	12.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen

Coordinator	dr. J.C. Slootweg
Examinator	dr. J.C. Slootweg
Level	600

Remarks
Period: variable

Master Research Project Communication Variant

Course code	X_432586 (432586)
Period	Ac. Year (September)
Credits	36.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	prof. dr. ir. R.V.A. Orru
Examinator	prof. dr. ir. R.V.A. Orru
Level	600

Course objective
please contact the mastercoordinator of your track

Master Research Project Education Variant

Course code	X_432587 (432587)
Period	Ac. Year (September)
Credits	36.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	prof. dr. ir. R.V.A. Orru
Examinator	prof. dr. ir. R.V.A. Orru
Level	600

Course objective
please contact the mastercoordinator of your track

Master Research Project Molecular Simulation and Photonics

Course code	X_432681 (432681)
Period	Ac. Year (September)
Credits	42.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. C. Fonseca Guerra
Examinator	dr. C. Fonseca Guerra
Level	600

Course objective
To obtain experience in theoretical and computational chemistry techniques and doing scientific research.

Remarks
Period: variable
Contact master coordinator: C.FonsecaGuerra@vu.nl

Master Research Project Molecular Simulation and Photonics - ext

Course code	X_432682 (432682)
Period	Ac. Year (September)
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. C. Fonseca Guerra
Examinator	dr. C. Fonseca Guerra
Level	600

Course objective
To obtain experience in theoretical and computational chemistry techniques and doing scientific research.

Remarks
Period: variable
Contact master coordinator: C.FonsecaGuerra@vu.nl

Master Research Project Molecular Simulation and Photonics - ext

Course code	X_432683 (432683)
Period	Ac. Year (September)
Credits	12.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. C. Fonseca Guerra
Examinator	dr. C. Fonseca Guerra
Level	600

Course objective
To obtain experience in theoretical and computational chemistry techniques and doing scientific research.

Remarks
Period: variable
Contact master coordinator: C.FonsecaGuerra@vu.nl

Master Research Project Molecular Simulation and Photonics - ext

Course code	X_432684 (432684)
Period	Ac. Year (September)
Credits	18.0

Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. C. Fonseca Guerra
Examinator	dr. C. Fonseca Guerra
Level	600

Remarks
Period: variable
Contact master coordinator: C.FonsecaGuerra@vu.nl

Master Research Project Society Oriented Variant

Course code	X_432588 (432588)
Period	Ac. Year (September)
Credits	36.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	prof. dr. ir. R.V.A. Orru
Examinator	prof. dr. ir. R.V.A. Orru
Level	600

Course objective
please contact the mastercoordinator of your track

Materials for energy and environmental sustainability

Course code	X_432850 ()
Period	Period 4+5
Credits	12.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. J.P. Dekker
Examinator	dr. J.P. Dekker
Teaching staff	dr. J.P. Dekker
Teaching method(s)	Lecture
Level	500

Course content
This course will help you understand critical relationships between the environment, energy and sustainability. The course will provide comprehensive coverage of each topic, bringing together diverse subject matter by integrating theory with engaging insights. It includes helpful features to aid understanding, including a historical overview and suggested questions for discussion.

Course reading
Book 'Fundamentals of Materials for Energy and Environmental Sustainability' by D.S. Ginley and D. Cahen (MRS, Cambridgre University Press)

Target group
Master SBI, track Life & Health and Energy & Sustainability

Medical Imaging

Course code	X_428526 (428526)
Period	Period 4
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Level	400

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/14926

Remarks
This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100. Enrolment via https://m.sis.uva.nl/vakaanmelden is required.

Minor Research Project Biomol. Analysis and Spectr.

Course code	X_432649 (432649)
Period	Ac. Year (September)
Credits	18.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. H. Lingeman
Examinator	dr. H. Lingeman
Level	500

Course objective
To acquire knowledge and insight into the role and objective of drug, bio-analytical and clinical development processes in complex samples using LC-MS and bio-assay-MS based approaches.

Course content
This project aims to provide the student with a theoretical and practical understanding of the issues involved in the design, conduct, analyses and interpretation of complex analytical studies.

Target group
mCh

Remarks
For further information please contact Henk Lingeman.

Minor Research Project Biomol. Analysis and Spectr.

Course code	X_432650 (432650)

Period	Ac. Year (September)
Credits	24.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. H. Lingeman
Examinator	dr. H. Lingeman
Level	500

Course objective
To acquire knowledge and insight into the role and objective of drug, bio-analytical and clinical development processes in complex samples using LC-MS and bio-assay-MS based approaches.

Course content
This project aims to provide the student with a theoretical and practical understanding of the issues involved in the design, conduct, analyses and interpretation of complex analytical studies.

Target group
mCh

Remarks
For further information please contact Henk Lingeman.

Minor Research Project Biomol. Analysis and Spectr.

Course code	X_432651 (432651)
Period	Ac. Year (September)
Credits	30.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. H. Lingeman
Examinator	dr. H. Lingeman
Level	500

Course objective
To acquire knowledge and insight into the role and objective of drug, bio-analytical and clinical development processes in complex samples using LC-MS and bio-assay-MS based approaches.

Course content
This project aims to provide the student with a theoretical and practical understanding of the issues involved in the design, conduct, analyses and interpretaion of complex analyical studies.

Target group
mCh

Remarks
For further information please contact Henk Lingeman.

Minor Research Project Organic Chemistry

Course code	X_432640 (432640)
Period	Ac. Year (September)
Credits	18.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. J.C. Slootweg
Examinator	dr. J.C. Slootweg
Level	500

Course objective
To obtain experience in organic chemistry techniques and doing scientific research.

Course content
the student can choose from a wide variety of research projects in main group chemistry, organometallic chemistry and catalysis

Type of assessment
presentation, report and practical work

Minor Research Project Organic Chemistry

Course code	X_432641 (432641)
Period	Ac. Year (September)
Credits	24.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. J.C. Slootweg
Examinator	dr. J.C. Slootweg
Level	500

Course objective
To obtain experience in organic chemistry techniques and doing scientific research.

Course content
the student can choose from a wide variety of research projects in main group chemistry, organometallic chemistry and catalysis

Type of assessment
presentation, report and practical work

Minor Research Project Organic Chemistry

Course code	X_432642 (432642)
Period	Ac. Year (September)
Credits	30.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. J.C. Slootweg

Examinator	dr. J.C. Slootweg
Level	500

Course objective
To obtain experience in organic chemistry techniques and doing scientific research.

Minor Research Project Theoretical Chemistry

Course code	X_432646 (432646)
Period	Ac. Year (September)
Credits	18.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. C. Fonseca Guerra
Examinator	dr. C. Fonseca Guerra
Level	500

Course objective
To obtain experience in theoretical and computational chemistry techniques and doing scientific research.

Recommended background knowledge
Computational (Pharmaco) Chemistry

Target group
Master Chemistry and DDS

Remarks
Period: variable

Minor Research Project Theoretical Chemistry

Course code	X_432647 (432647)
Period	Ac. Year (September)
Credits	24.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. C. Fonseca Guerra
Examinator	dr. C. Fonseca Guerra
Level	500

Course objective
To obtain experience in theoretical and computational chemistry techniques and doing scientific research.

Recommended background knowledge
Computational (Pharmaco) Chemistry

Target group

mCH and mDDS

Remarks
Period: variable

Minor Research Project Theoretical Chemistry

Course code	X_432648 (432648)
Period	Ac. Year (September)
Credits	30.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. C. Fonseca Guerra
Examinator	dr. C. Fonseca Guerra
Level	500

Course objective
To obtain experience in theoretical and computational chemistry techniques and doing scientific research.

Recommended background knowledge
Computational (Pharmaco) Chemistry

Target group
mCH: MSP and MDSC track

Remarks
Period: variable

Molecular Computational Chemistry

Course code	X_435666 (435666)
Period	Period 5
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	prof. dr. F.M. Bickelhaupt
Examinator	prof. dr. F.M. Bickelhaupt
Teaching staff	prof. dr. F.M. Bickelhaupt, dr. C. Fonseca Guerra
Teaching method(s)	Lecture, Practical
Level	400

Course objective
To learn the background of modern computational methods and in particular their application in computer-assisted solving of chemical problems.

Course content
Computational chemistry plays a central role in modern chemical research. Various molecular properties can be computed with chemical accuracy. In this way, information can be obtained about quantities that are experimentally inaccessible yet indispensible for molecular design

and synthesis. One of the main objectives of this course is to learn current state-of-the-art quantum chemical methods and computer software. This courses deals with ab initio theory (among others, Hartree-Fock and Møller-Plesset theory) and modern density functional theory (DFT).

These methods are applied in a computer lab in order to get acquainted with important modeling skills, such as, geometry optimization (molecular structure, stability, and thermochemistry)) and the exploration of potential energy surfaces (kinetics, reaction mechanism).

A second main objective is to develop skills for casting an (experimental) chemical problem into a computational approach leading to a practical solution. Furthermore, the course provides an introduction into creating physical models that help interpreting experimental as well as computational data. An important issue in this course is the unifying power of computational chemistry: the same theoretical models serve as tools for solving very diverse problems from all branches of chemistry, ranging from organic chemistry and catalysis via biochemistry till pharmaceutical sciences.

Form of tuition
Theory classes and hands-on computer lab as well as short research project.

Type of assessment
Presentation of research project for peers and supervisors.

Course reading
Errol G. Lewars
Computational Chemistry (Introduction to the Theory and Applications of Molecular and Quantum Mechanics) Second Edition
Springer: Dordrecht, Heidelberg, London, New York

Target group
mCh, mDDS

Molecular Photodynamics

Course code	X_432701 (432701)
Period	Period 4
Credits	3.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	prof. dr. M.H.M. Janssen
Examinator	prof. dr. M.H.M. Janssen
Level	500

Course objective
The objective of this course is to make students familiar with detailed chemical dynamics in chemical processes. In particular the importance of photochemical bondbreaking and atmospheric (troposhere and stratosphere) photochemistry will be presented. The role of fundamental physical forces that determine the dynamics and energetics of chemical bondbreaking will be discussed. The students will learn about the latest state-of-the-art experimental technology to follow a chemical reaction

in real time. In particular lasers and their phenomenal potential in chemical research will be discussed.

Course content
We will discuss the role of forces and the Born-Oppenheimer potential in chemical bondbreaking. Photochemistry, energetics and angular properties of molecules and chemical reactions will be presented. Photons, light, lasers and their potential for the study of chemical reactions and applications in various areas of chemistry will be discussed. Laser spectroscopy, atmospheric chemistry, global warming and the role of greenhouse gasses will be discussed. State-of-the-art developments in physical chemistry like the mass-spectrometric detection of chiral molecules by femtosecond laser technology and three-dimensional particle imaging will be presented.

Type of assessment
To be determined in consultation with the student.

Course reading
To be determined in consultation with the lecturer.

Target group
Students interested in state-of-the-art developments in physical chemistry and laser spectroscopy.

Remarks
Period: in consultation with the lecturer.

Networked Organizations and Communication

Course code	S_NOC ()
Period	Period 2
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Sociale Wetenschappen
Coordinator	dr. I.R. Hellsten
Examinator	dr. I.R. Hellsten
Teaching staff	dr. I.R. Hellsten
Teaching method(s)	Lecture, Practical, Study Group
Level	500

Course objective
Students who have completed the seminar will be able to critically approach, interpret, and compare theories and literature on social networks, semantic networks, and networked organizations. They can write a literature review or about the developing field of networked organizations and communication. Moreover, they can carry out a small-scale research project (in groups) using a software tool ORA/Automap to conduct social and semantic network analysis on text documents, and reflect on the results.

Course content
The seminar Networked Organizations and Communication aims at gaining in-depth insight into networks and network analysis. The seminar begins with an introduction to network theory, general terms, and concepts. On

the basis of recent network literature, the seminar then focuses on how organizations and organizational members become more connected to each other (e.g., through actor similarity, communication patterns, etc.). A particular focus will thus be on gaining insights into social and semantic networks and on the software program with which one can analyze and visualize social or semantic networks. This course addresses three aspects of organizational networks: structure, content and meaning.

Form of tuition
Lectures combined with workshops about two different network analysis methods. Active participation in the lectures and method workshops is required.

Type of assessment
Possibly small tests during class, individual literature review, group assignment (research project), and an individual reflection assignment.

Course reading
Series of articles to be announced on Blackboard.

Entry requirements
All students are recommended to study chapters 1, 2, 3, 7, and 10 of Kadushi, C., 2012: Understanding social networks. Oxford University Press: New York.

Recommended background knowledge
All students are recommended to study chapters 1, 2, 3, 7, and 10 of Kadushi, C., 2012: Understanding social networks. Oxford University Press: New York.

Target group
MSc BCO track Strategie en identiteit, exchange students, and students SBI.

Nuclear Magnetic Resonance

Course code	X_435667 (435667)
Period	Period 4
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Teaching method(s)	Lecture
Level	500

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/17239

Registration procedure
Course registration at the UVA is compulsory at least 4 weeks before the start of the semester via https://www.sis.uva.nl

Remarks
This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.
Enrolment via https://m.sis.uva.nl/vakaanmelden is required.

Numerical Techniques

Course code	X_420082 (420082)
Period	Period 4+5
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Teaching method(s)	Lecture
Level	400

Course content
The course description is available on
http://studiegids.uva.nl/web/uva/sgs/nl/c/220.html

Target group
mCh-MSP

Remarks
Course registration at the UVA is compulsory at least 4 weeks before the start of the semester via https://www.sis.uva.nl

Open Innovation in Science and Sustainability

Course code	X_422598 ()
Period	Period 2
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	drs. P. van Hoorn
Examinator	drs. P. van Hoorn
Teaching staff	drs. P. van Hoorn
Teaching method(s)	Lecture
Level	400

Course objective
In this final course in the Business and Innovation course series across the Bachelor SBI program, the challenges involved in 'Open Innovation' (OI) are the central theme. Classes cover the dominant OI theoretical insights and crucial aspects of OI based on various pieces of literature, relevant book chapters and casework on the subject. Students will gain insight in the emergence, distribution, application and marketing of scientific knowledge in a complex network of stakeholders. Through the case work assignments, teams will learn to apply OI principles and aim to take on inherent OI challenges in transitions that are taking place in both the Energy and Life sciences sectors in society. OI in S is fully taught in English, spoken, written and read.

Course content
1. Theories, trends and practice of OI through literature study which also will be presented and discussed in class. These materials

are the subject of a final written exam.
2. Assigments based on actual cases, including Harvard Cases.
In this course two cases will be presented with the purpose of demonstrating the dilemma's that open innovation practices inevitably lead to. And to subsequently apply the theoretical OI principles to both cases through executing a team assignment.
Case A: Vertex and the CF Foundation have developed a novel drug. The R&D trajectory breaks the mold of the fully-integrated pharma approach to development through aspects like: advocacy group financing of research, end-user driven innovation, ownership position of developers, R&D within a heterogeneous network and last but not least, patient benefit as the primary driver. (two Harvard cases: a: Vertex and b: Bob Beale and the CFF)
Case B: Alliander, an energy supply and network company drives an international network of innovator start-ups collectively playing in the smart grid space. Also here, the setting provides many challenges that test the OI framework.

Form of tuition
Lectures, guest lectures, casework, presentations and reports.
OI in S is fully taught in English e.g. spoken, written and read.

Type of assessment
The final course grade is composed of a grade on casework per team (50%) and individual written exam (50%).
The assignment outputs include a final report and a presentation per team, where individual group member contribution is identified for grading.

M Phys students will work in tandem with SBI students on assignment execution. M Phys students will work on specific detail questions and assignment components that are aligned with their level of education and training.

Course reading
Selected chapters from :
- Open Innovation, Researching a New Paradigm. By Henry Chesbrough et al. (2008)
- Open Innovation Research Management and Practice by Tidd et al (2014)
- Higgens et al - Vertex Ph and the CFF: Venture Philantropy Funding for Biotech (by Harvard Business School)
- Kaplan et al – Bob Beall at the CFF (2009) (by Harvard Business School).

Entry requirements
Natural sciences courses, including Physics and (Bio)Chemistry (level 100 - 200) as well as basics in Innovation sciences. On a per case basis, additional pre-reading materials are available for students who have a gap in one of the above areas.

Target group
MPhys

Remarks
Should you have any questions about this course or the enrollment requirements, please send an Email to < p.van.hoorn@vu.nl $gt;

Organic Photovoltaics

Course code	X_422590 ()
Period	Period 5
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. E.L. von Hauff
Examinator	dr. E.L. von Hauff
Teaching staff	dr. E.L. von Hauff
Teaching method(s)	Lecture
Level	400

Course objective
The aim of this course is introduce students to the emerging topic of organic and hybrid photovoltaics. The concepts presented will build on students' previous basic knowledge of physics and chemistry and extend these towards current research questions pertaining to the design and implementation of organic semiconductors in the field of energy conversion.

The course is successful if students gain insight into the physical and chemical principals of energy conversion with emerging materials. The focus will be placed on relevant questions and issues related to photovoltaics, semiconductor material processing and design, and the role of low cost and non-toxic material systems for future energy applications.

Course content
The course is comprised of three main topics:
• Properties of organic and hybrid/perovskite semiconductors – The optical, electrical and structural properties, as well as fabrication and characterisation techniques will be introduced.
• Photovoltaic energy conversion – photovoltaic energy conversion is based on the absorption of light, the separation and transport of charge carriers, the collection of photocurrent. These processes will be discussed in terms of the material properties.
• Current research questions in emerging photovoltaics – charge carrier separation and transport is a unique problem in organic semiconductors. Defects and structural attributes of perovskite materials. Correlations between material properties and solar cell efficiency will be established.

Form of tuition
Introductory lectures for each module (with homework). Workshop-style student presentations dealing with research articles.

Type of assessment
Student-presentations during the lectures; Reports; Participation

Course reading
Literature (will be assigned during lectures)

Target group
mPhy
mCh
Part of track Science for Energy and Sustainability

Peergroup 1

Course code	O_MLPEERGR_1 ()
Period	Period 1+2+3, Period 4+5+6
Credits	0.0
Language of tuition	Dutch
Faculty	Fac. der Gedrags- en Bewegingswetensch.
Coordinator	dr. A. Handelzalts
Examinator	dr. A. Handelzalts
Teaching method(s)	Study Group
Level	400

Peergroup 2

Course code	O_MLPEERGR_2 ()
Period	Period 3+4+5
Credits	0.0
Language of tuition	Dutch
Faculty	Fac. der Gedrags- en Bewegingswetensch.
Coordinator	dr. A. Handelzalts
Examinator	dr. A. Handelzalts
Teaching method(s)	Study Group

Photosynthesis and Energy

Course code	X_422553 (422553)
Period	Period 5
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. I.H.M. van Stokkum
Examinator	dr. I.H.M. van Stokkum
Teaching staff	prof. dr. R. van Grondelle
Teaching method(s)	Lecture
Level	500

Course objective
Introduce the fundamental aspects of photosynthesis and photosynthetic energy conversion.

Course content
Photosynthesis: an overview of the biological processThe relevant structures: pigments, proteins, the photosynthetic membrane Excitation energy transfer and excitons
Disorder Charge separation by the reaction center and electron transfer Charge stabilisation Proton coupled electron transfer The energetics of

photosynthesis Arificial photosynthesis

Form of tuition
Lectures, literature study, presentations

Type of assessment
Scriptie plus presentation of subject related to photosynthesis.

Course reading
Blankenship, R.E., Molecular Mechanisms of Photosynthesis. Blackwell 2002.

Target group
mPhys-PLH, mPhys-AMEP, mCH-SES, mPhys-SES

Photovoltaics

Course code	X_428516 (428516)
Period	Period 4
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Level	400

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/18185

Remarks
This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.
Enrolment via https://m.sis.uva.nl/vakaanmelden is required.

Physical-Organic Chemistry

Course code	X_435663 (435663)
Period	Period 1
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	prof. dr. K. Lammertsma
Examinator	prof. dr. K. Lammertsma
Teaching method(s)	Lecture, Seminar
Level	400

Course objective
Survey of structural features, reaction mechanisms, and physical organic concepts needed in organic chemistry.

Course content
Advanced organic chemistry course centered around chemical bonding, stereochemical principles, conformational and stereo-electronic effects, isotope effects, reaction mechanisms, nucleophilic

substitutions, eliminations, aromaticity, carbocations, carbanions, radicals, pericyclic reactions, and acid-base catalysis. These structural and mechanistic concepts are essential in organic synthesis.

Form of tuition
Lectures and tutorials with homework

Type of assessment
Written or oral examination and assignments.

Course reading
Anslyn, E.V., and Doggerty, D.A., Modern Physical Organic Chemistry. University Science Books, 2006.

Entry requirements
BSc

Recommended background knowledge
BSc S, BSc F

Target group
mCh, mF

Policy, Politics and Participation

Course code	AM_470589 ()
Period	Period 2
Credits	6.0
Language of tuition	English
Faculty	Fac. der Aard- en Levenswetenschappen
Coordinator	dr. R.M. Edelenbosch MSc
Examinator	dr. R.M. Edelenbosch MSc
Teaching staff	dr. B.J. Regeer, dr. J.F.H. Kupper, prof. dr. J.E.W. Broerse
Teaching method(s)	Lecture, Study Group
Level	500

Course objective
To further deepen your analytic skills with respect to the assessment of a specific societal problem;
To acquire further insight into the practice of interactive research;
To acquire further insights into specific methods and techniques of interactive research;
To strengthen the skills to design an interactive research project
To practice skills in data collection and analysis;
To learn to set up valid lines of argumentation;
To improve your communication skills;
To improve your skills in working effectively in a project team, through team building, team analysis and feedback.

Course content
In this course you get the chance to gain experience in the practical implementation of methodologies for interactive research. In a four week policy project you will both improve your focus group research skills and deepen your understanding of the relevant theoretical concepts in

the areas of policy studies, science and technology studies and democracy theory. In a group of about ten students you will participate in a real interactive research project which is executed at the Athena institute. In this project you will be trained in and practice various skills for data collection (such as focus group design and facilitation) and data analysis (such as qualitative content analysis).
Specific attention is paid to your personal interactive research skills. At the end of the course, you prepare a policy report to present your findings. In an oral presentation your team will highlight the main results of your analysis and defend the recommendations you propose.

Form of tuition
Lectures: 14 hours
Training workshops: 4 hours
Project assignment: 102 hours
focus group execution: 6 hours
Final presentations project results: 4 hours
Self study: remaining hours

Type of assessment
The course does not have an oral or written exam. You will be assessed on the basis of the group assignment, a group presentation and on your individual performance during the course (in the work groups, your facilitation skills in the 'real' focus groups). For all parts a pass grade (> 5.5) needs to be obtained in order to receive a final mark.

Your final mark will be based on: the group report (40%): oral presentation per group(40%): individual performance (20%).

Course reading
To be announced on Blackboard

Entry requirements
Basic knowledge of (interactive) policy processes, policy analysis and relevant research skills are required.

Target group
Optional course for Master students Management, Policy Analysis and Entrepreneurship in Health and Life sciences (MPA), Societal differentiation of the Health, Life & Natural Sciences.

Registration procedure
Registration deadline by VUnet is 4 weeks before the start of the course.

Remarks
As the project depends on team work, attendance is compulsory.

Praktijk 1

Course code	O_MLPRAK_1 ()
Period	Period 1, Period 4
Credits	6.0
Language of tuition	Dutch
Faculty	Fac. der Gedrags- en Bewegingswetensch.
Coordinator	dr. A. Handelzalts

Examinator	dr. A. Handelzalts
Teaching staff	drs. J.K.W. Riksen, drs. H.R. Goudsmit, drs. Y.G. Meindersma, ir. E.J.F. Scheringa, drs. W.S. Hoekstra, drs. C.D.P. van Oeveren, drs. S. Donszelmann, drs. L.J. van Well-van Grootheest, dr. H.B. Westbroek, C.L. Geraedts, drs. A. Krijgsman, dr. A.A. Kaal, dr. A. Handelzalts, drs. K.L. Schaap, W. Maas, F.L. de Vries MSc, drs. H. Stouthart, drs. I. Pauw
Teaching method(s)	Study Group
Level	400

Praktijk 2

Course code	O_MLPRAK_2 ()
Period	Period 2+3, Period 5+6
Credits	9.0
Language of tuition	Dutch
Faculty	Fac. der Gedrags- en Bewegingswetensch.
Coordinator	dr. A. Handelzalts
Examinator	dr. A. Handelzalts
Teaching staff	drs. J.K.W. Riksen, drs. H.R. Goudsmit, drs. Y.G. Meindersma, ir. E.J.F. Scheringa, drs. W.S. Hoekstra, drs. C.D.P. van Oeveren, drs. S. Donszelmann, dr. H.B. Westbroek, C.L. Geraedts, drs. A. Krijgsman, dr. A.A. Kaal, dr. A. Handelzalts, drs. K.L. Schaap, W. Maas, F.L. de Vries MSc, drs. H. Stouthart, drs. I. Pauw
Teaching method(s)	Study Group
Level	400

Praktijk 3

Course code	O_MLPRAK_3 ()
Period	Period 4+5+6
Credits	15.0
Language of tuition	Dutch
Faculty	Fac. der Gedrags- en Bewegingswetensch.
Coordinator	dr. A. Handelzalts
Examinator	dr. A. Handelzalts
Teaching staff	drs. J.K.W. Riksen, drs. H.R. Goudsmit, drs. Y.G. Meindersma, ir. E.J.F. Scheringa, drs. W.S. Hoekstra, drs. C.D.P. van Oeveren, drs. S. Donszelmann, dr. H.B. Westbroek, C.L. Geraedts, drs. A. Krijgsman, dr. A.A. Kaal, dr. A. Handelzalts, drs. K.L. Schaap, W. Maas, F.L. de Vries MSc, drs. H. Stouthart, drs. I. Pauw
Level	400

Praktijk onderzoek 1

Course code	O_MLPROZ_1 ()
Period	Period 3, Period 6
Credits	3.0
Language of tuition	Dutch
Faculty	Fac. der Gedrags- en Bewegingswetensch.
Coordinator	dr. H.B. Westbroek
Examinator	dr. H.B. Westbroek
Teaching staff	drs. J.K.W. Riksen, drs. H.R. Goudsmit, drs. Y.G. Meindersma, ir. E.J.F. Scheringa, dr. M. Meeter, drs. W.S. Hoekstra, drs. C.D.P. van Oeveren, drs. S. Donszelmann, drs. B. Klein, drs. W. Jongejan, drs. L.J. van Well-van Grootheest, dr. T. Bosma, dr. H.B. Westbroek, C.L. Geraedts, drs. A. Krijgsman, dr. J.M.H. Swennen, dr. A.A. Kaal, dr. A. Handelzalts, drs. K.L. Schaap, W. Maas, F.L. de Vries MSc, drs. H. Stouthart, drs. I. Pauw
Teaching method(s)	Study Group, Lecture
Level	400

Praktijk onderzoek 2

Course code	O_MLPROZ_2 ()
Period	Period 4+5+6
Credits	6.0
Language of tuition	Dutch
Faculty	Fac. der Gedrags- en Bewegingswetensch.
Coordinator	dr. H.B. Westbroek
Examinator	dr. A. Handelzalts
Teaching staff	drs. J.K.W. Riksen, drs. H.R. Goudsmit, drs. Y.G. Meindersma, ir. E.J.F. Scheringa, dr. M. Meeter, drs. W.S. Hoekstra, drs. C.D.P. van Oeveren, drs. S. Donszelmann, drs. B. Klein, drs. W. Jongejan, drs. L.J. van Well-van Grootheest, dr. T. Bosma, dr. H.B. Westbroek, C.L. Geraedts, dr. J.M.H. Swennen, dr. A.A. Kaal, dr. A. Handelzalts, drs. K.L. Schaap, W. Maas, F.L. de Vries MSc, drs. H. Stouthart, drs. I. Pauw
Teaching method(s)	Lecture, Seminar
Level	400

Principles of Pharmaceutical Sciences / Pharmacochemistry

Course code	X_435675 (435675)
Period	Period 1
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	prof. dr. I.J.P. de Esch
Examinator	prof. dr. I.J.P. de Esch
Teaching staff	prof. dr. I.J.P. de Esch

Teaching method(s)	Lecture
Level	400

Course objective
General introduction into and deepening of knowledge of concepts, mechanisms and recent developments in pharmaceutical sciences and the pharmaceutical and biotech industry.

Course content
This course is designed for students with an interest in life sciences and the biotech/pharmaceutical industry but without prior education in this field. A general introduction will be given to the process of drug discovery, drug design and synthesis, drug development and drug safety assessment. Subsequently, potential drug targets, mechanisms of drug actions (including drug-receptor/enzyme Using various drug classes, relationships between chemical structures and biological activities will be derived and illustrated. Finally, various modern developments and tools will be illustrated by recent applications in the field of drug research, medicinal chemistry and toxicology.

Form of tuition
Lectures and tutorials.

Type of assessment
Written examination

Course reading
Patrick, G., An Introduction to Medicinal Chemistry 5th ed.
Oxford: Oxford University Press. 2009, ISBN: 978-0-19-969739-7

Target group
3S, 3MNW, mCh, mPhys.
The course is optional for mDDS students that did not follow the VU University BSc Pharmaceutical sciences and these mDDS students should contact the mDDS coordinator before enrolling.
The course is recommended for SBI (life) mastertrack students, except for students with an bachelor in SBI or pharmaceutical sciences.

Project Sustainable Future

Course code	X_432784 ()
Period	Period 6
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. J.C. Slootweg
Examinator	dr. J.C. Slootweg
Teaching method(s)	Lecture, Seminar
Level	500

Course content
Human civilization finds itself at a pivotal point in history. As a result of the growing world population as well as extensive industrial and societal developments that have taken place over the last 150 years,

humanity has exploited earth's natural resources up to a point that further developing or even maintaining current levels of prosperity cannot be sustained. In addition, it has become very clear that current fossil fuel based energy technologies have a dramatic adverse effect on the global climate. These issues becomes even more urgent when considering the anticipated elevated prosperity levels in the developing world.

These developments lie at the basis of the concept of 'sustainability': the future has to be radically different from past and present in the sense that human activities must be carried out in such a way that they can be sustained for many generations. To achieve this, many aspects of human activity have to be changed: different technologies for energy production and resource utilization will have to be developed. Choices will have to be made as of which of these new technologies are considered most favorable for society. Such technologies will have to be implemented at large scale, which requires involvement of decisive societal forces, such as governments, markets, producers and consumers. Only if clear, rational and appealing visions are developed can such societal forces be activated and the required changes be realized.

In this course, we will consider a number of acute sustainability themes that humanity faces today. The students' mission of this course will be to define under which conditions new technologies can make a meaningful contribution to a sustainable future of our society in a specific case study. The project will be divided in 4 discrete steps:
1. We will analyze the scientific basis of the issue under consideration. We will analyze the potential, but also the limitations of each technology.
2. We will analyze what 'sustainability' actually means. The term is often used in a loose and informal way. But 'sustainability' only becomes meaningful when it is made quantitative! We will apply these concepts to the chosen theme, and define the conditions that are required to make the new technologies deserve the label 'sustainable'.
3. To assess and potentially quantify the uncertainties and risks with regard to the different technology solutions, how these could affect society now and in the future (through applying scenario planning techniques).
4. We will integrate the knowledge and insights obtained from the above three approaches, to understand how they are interconnected and how they influence one another.

Form of tuition
lectures, guest lectures, werkcolleges, group work, self study

Type of assessment
written exam
project report
presentation of project report
literature exercise

Target group
mCh-SES, mPhys-SES

Protein Analysis

Course code	X_435045 (435045)
Period	Period 5

Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. H. Lingeman
Examinator	dr. H. Lingeman
Teaching staff	dr. H. Lingeman
Teaching method(s)	Lecture
Level	500

Course objective
Providing a clear overview on the principles and techniques that can be used for the qualitative and quantitative determination of protein-type of compounds.

Course content
The qualitative and quantitative determination of protein frequently is performed by a combination of chromatographic /electrophoretic and mass spectrometric techniques. The principles of these techniques will be discussed as well as their applications. Special attention will be given to sample treatment procedures and affinity-based separation techniques. With respect to the identification of unknown biological macromolecules, the power of hyphenated techniques in combination with the various modes of mass spectrometry will be highlighted.

Form of tuition
Lectures and tutorials

Type of assessment
Oral examination.

Course reading
Hand-outs (electronically available).

Entry requirements
Basic knowledge of biochemistry, separation sciences, spectroscopy and mass spectrometry.

Target group
mCh-AS, mCh-MDSC, mDDS-BCCA, mDDS-DDTF

Protein Science

Course code	AM_470145 ()
Period	Period 1
Credits	6.0
Language of tuition	English
Faculty	Fac. der Aard- en Levenswetenschappen
Coordinator	dr. D. Bald
Examinator	dr. D. Bald
Teaching staff	dr. M.H. Siderius, prof. dr. ir. E.J.G. Peterman, dr. J.N.M. Commandeur, dr. D. Bald, prof. dr. M.J. Smit
Teaching method(s)	Lecture, Study Group

Level	400

Course objective
The student:
1. knows and understands principles of protein structure,, dynamics, regulation, inhibition, interaction and engineering
2. can explain protein function based on protein structure and the proprties of amino acid residues.
3. can predict the function of (parts of) a protein based on undestanding of its molecular properties
4. knows and understands the principle of current methods for protein investigation (e.g. overproduction, purification, interaction, engineering)
5. can analyze the strong and weak points of Protein Science techniques and can correlate an open question with a suitable technique.
6. can analyze experiments in Protein Science and design new experiments.

Course content
We will start with a repetition of protein structure and function. Subsequently, we will focus on methods in protein science and also on more specialized properties of proteins important in fundamental research, biomedicine or biotechnology. Finally we will deal with case studies on selected proteins.
Lecture topics include:
Protein Structure, Protein Function, Protein Dynamics, Molecular Machines, Control of Protein Function, Protein inhibition, Antibiotic action, Development of antibiotics and antibiotic resistance, Protein over-expression and purification, Protein Interaction, Protein Engineering,
Molecular Modeling and docking
Case studies:
GPCRs as drug target, Cytochrome P450, Chaperones as Protein folding machines,
Molecular Modeling/docking.

Form of tuition
Lectures (30 h) accompanied by work (paper) discussions (6 h) and self study
(individual or in small groups) to prepare for the lectures and to discuss the material presented in lectures/accompanying papers.

Type of assessment
Written exam (100%)

Course reading
No special book required. Useful may be "Protein Structure and Function" by Petsko/Ringe. You can also use any Biochemistry textbook (e.g. Voet and Voet) for repetition. You will receive material (reviews and original articles on relevant topics). Examples of scientific literature: Lee et al. Nature 2010, Bax et al. Nature 2010, and Kumar Exp. Opin. Drug Metab 2010.

Target group
Masters students Biomolecular Sciences, Biomedical Sciences, Biology, Pharmaceutical Sciences and Medical Natural Sciences

Remarks
Visiting lecturer: Dr. Anil Koul, Tibotec J&J

Quantum Theory of Molecules and Matter

Course code	X_428517 (428517)
Period	Period 1
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Level	400

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/20739

Remarks
This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.
Enrolment via https://m.sis.uva.nl/vakaanmelden is required.

Reflective Practice Internship Science Communication

Course code	AM_1163 ()
Period	Ac. Year (September)
Credits	30.0
Language of tuition	English
Faculty	Fac. der Aard- en Levenswetenschappen
Coordinator	dr. J.F.H. Kupper
Level	600

Course objective
The internship is a compulsory part of the Master's programme. The aims of the internship are:
• Learn to independently apply and expand your practical science communication skills in one particular area of the field (writing, multi-media, facilitation, policy and strategy development, content design, etc.).
• Critical self-assessment and reflection on acquired science communication competencies in the field.
• Conduct scientific research independently: assess scientific information, design a research project, apply scientific methods, collect data, report and discuss findings.
• Present and discuss about internship and research outcomes.
• Learn to cooperate with researchers and practitioners of various disciplines.
• Gain an impression of a potential future field of career.

Course content
When you are enrolled in the VU Science Communication specialization or the UvA Major Science Communication you need to conduct one internship (30 ECTS, 5 months). One of the two possible formats is the Reflective Practice Internship (RPI). The complete and up-to-date information about

the internship can be found in the SC internship guide line on blackboard (science communication community).

Form of tuition
Work-based placement

Type of assessment
Written report and oral presentation.
Within six weeks after the start of the master internship, an interim evaluation will take place to assess whether there is a reasonable chance of the placement being brought to a successful completion.
The internship is supervised and assessed by two lecturers. Both lecturers are members of the academic staff at VU University Amsterdam.
The day-to-day supervision can be carried out by a trainee research assistant (AIO), postdoc or researcher.

Target group
Students MSc Earth science year 2

Remarks
Participation in this compulsory component is only permitted if the student meets the relevant requirements for admission. These requirements are detailed in the Internship guidelines of Earth science (on
Blackboard) and in the Academic and Examination Regulations.
The work-based placement is subject to the FALW document: “Student placement (internship) and literature regulations”. These regulations require detailed written agreements between supervisors and student that specify the conditions for the Master research project. This agreement should be sent for approval by the science communication co-ordinator at least two weeks before the planned start of the work-based placement.
If the proposal is of sufficient quality, you can start your internship.
If not, you’ll need to adapt your proposal and send it for approval again. You can only start your internship after your research design has been approved.
The placement may be extended by 6 EC, subject to conditions that can be found in the FALW document “Student placement (internship) and literature regulations”. The student must send a request for extension to the Earth science Examination Board.
Information on Master internships is made available on Blackboard.

Research I

Course code	O_MLVPOOI ()
Period	Period 1+2+3
Credits	3.0
Language of tuition	Dutch
Faculty	Fac. der Gedrags- en Bewegingswetensch.
Coordinator	dr. A. Handelzalts
Examinator	dr. A. Handelzalts
Teaching staff	drs. J.K.W. Riksen, drs. H.R. Goudsmit, drs. Y.G. Meindersma, drs. I. Pauw, drs. W.S. Hoekstra, drs. C.D.P. van Oeveren, drs. S. Donszelmann, drs. W. Jongejan, dr. H.B. Westbroek, C.L. Geraedts, drs. A. Krijgsman, prof. dr. J.J. Beishuizen, dr. A.A. Kaal, drs. K.L. Schaap, W. Maas, F.L. de Vries MSc, drs. H. Stouthart

Teaching method(s)	Lecture, Seminar
Level	500

Research II

Course code	O_MLVPOOII ()
Period	Period 1+2+3
Credits	6.0
Faculty	Fac. der Gedrags- en Bewegingswetensch.
Coordinator	dr. H.B. Westbroek
Examinator	dr. H.B. Westbroek
Teaching staff	drs. W. Jongejan, dr. T. Bosma, dr. H.B. Westbroek, dr. A.A. Kaal, dr. A. Handelzalts, W. Maas
Teaching method(s)	Lecture, Seminar
Level	500

Research Internship Science Communication

Course code	AM_1162 ()
Period	Ac. Year (September)
Credits	30.0
Language of tuition	English
Faculty	Fac. der Aard- en Levenswetenschappen
Coordinator	dr. J.F.H. Kupper
Level	600

Course objective
The internship is a compulsory part of the Master's programme. The aims of the internship are:
• Learn to independently apply and expand your practical science communication skills in one particular area of the field (writing, multi-media, facilitation, policy and strategy development, content design, etc.).
• Critical self-assessment and reflection on acquired science communication competencies in the field.
• Conduct scientific research independently: assess scientific information, design a research project, apply scientific methods, collect data, report and discuss findings.
• Present and discuss about internship and research outcomes.
• Learn to cooperate with researchers and practitioners of various disciplines.
• Gain an impression of a potential future field of career.

Course content
When you are enrolled in the VU Science Communication specialization or the UvA Major Science Communication you need to conduct one internship (30 ECTS, 5 months). One of the two possible formats is the full Research Internship. The complete and up-to-date information about the internship can be found in the SC internship guide line on blackboard (science communication community).

Form of tuition
Work-baed placement

Type of assessment
Written report and oral presentation.
Within six weeks after the start of the master internship, an interim evaluation will take place to assess whether there is a reasonable chance of the placement being brought to a successful completion.
The internship is supervised and assessed by two lecturers. Both lecturers are members of the academic staff at VU University Amsterdam. The day-to-day supervision can be carried out by a trainee research assistant (AIO), postdoc or researcher.

Target group
Students Earth science year 2

Remarks
Participation in this compulsory component is only permitted if the student meets the relevant requirements for admission. These requirements are detailed in the Internship guideline of science communication (on
Blackboard) and in the Academic and Examination Regulations.
The work-based placement is subject to the FALW document: “Student placement (internship) and literature regulations”. These regulations require detailed written agreements between supervisors and student that specify the conditions for the Master research project. This agreement should be sent for approval by the science communication internship or master co-ordinator
at least two weeks before the planned start of the work-based placement.
If the proposal is of sufficient quality, you can start your internship.
If not, you’ll need to adapt your proposal and send it for approval again. You can only start your internship after your research design has been approved.
The placement may be extended by 6 EC, subject to conditions that can be found in the FALW document “Student placement (internship) and literature regulations”. The student must send a request for extension to the earth science Examination Board.
Information on Master internships is made available on Blackboard.

Research methods for analyzing complex problems

Course code	AM_1182 ()
Period	Period 1
Credits	6.0
Language of tuition	English
Faculty	Fac. der Aard- en Levenswetenschappen
Coordinator	dr. M.E. Arentshorst MSc
Examinator	dr. M.E. Arentshorst MSc
Teaching method(s)	Lecture, Seminar, Computer lab
Level	400

Course objective
The objectives of this course are:

- To understand the differences between beta- and gamma research;
- To acquire insight in and understanding of a real world research process, including knowledge of the character of complex societal issues and the needs, advantages and disadvantages of real world research;
- To acquire insight into various quantitative and qualitative research methods, their underlying theoretical concepts and their relative strengths and weaknesses;
- Being able to apply these various quantitative and qualitative research methods in a specific societal context;
- To interpret quantitative and qualitative findings;
- Being able to create an adequate research design for the investigation of a specific complex societal problem.

Course content
Contemporary societies increasingly face complex social problems, such as climate change, HIV/ AIDS or ethnic and religious diversity. These complex problems involve a variety of social actors: policy-makers, professionals, NGOs, industries, science and, of course, the public at large. Addressing these complex issues demands an approach that investigates, analyzes and integrates the positions and knowledge of different actors.

This course offers an (advanced) introduction to various research methods used in real world research, including questionnaires, systematic observations, surveys and statistics, semi-structured interviews, and focus groups. These methods are commonly used in research into complex problem contexts, communication and opportunities for intervention. Strengths and weaknesses of each research method and technique will be discussed, as well as its possibility to be applied in different societal contexts.

Form of tuition
Research Methods for Analyzing Complex Problems is a fulltime course of four weeks (6 ECTS). The total study time is 160 hours. Tuition methods include lectures, workgroups, workshops, group project work and self-study.

The different elements have the following study time:
- lectures 20 hours
- workgroups and training 36 hours
- examination 3 hours
- project work & reading (self-study) Remaining hours

Please note that attendance to the workgroup sessions is compulsory. If you miss one workgroup, with a good reason, you will receive an additional assignment. If you miss more than one workgroup session it is no longer possible to pass the project part of the course.

Attendance to the lectures is highly recommended. In our experience, relying on self-study alone is insufficient to apply the theory of the lectures in the assignments of the workgroups, and to pass the exam.

Type of assessment
The course grade is based on the group assignment 'study design' and the exam. Both aspects need to be graded 6.0 or higher.

Exam 50% of total grade
Group assignment 'study Design' 50% of total grade

Course reading
The literature of this course consists of selected scientific articles that are provided on blackboard, and the books:
- Verschuren, D.E. and Doorewaard, H. (2010). Designing a Research Project
(2nd edition)Eleven International Publishing, the Hague. ISBN 978-90-5931-572-3.
- Gray, D.E. (2014) Doing Research in the Real World (3rd edition)Sage Publications Ltd, United Kingdom. ISBN 978-1-4462-6019-7

An overview of the literature per lecture will be provided on blackboard.

Target group
The course 'Research Methods for Analyzing Complex Problems' is a compulsory course for first year master students 'Management, Policy Analysis and Entrepreneurship in Health and Life Sciences'. This course is also a compulsory course within the Science communication- and Societal differentiations of Health, Life and Natural Sciences Master programmes. It is an optional course for other Life Sciences Master program students at the VU University.

Registration procedure
VUnet

Remarks
Lectures are in English, part of the workgroups are in Dutch. The assignments are written in English.

Please note that attendance to the workgroup sessions is compulsory. If you miss one workgroup, with a good reason, you will receive an additional assignment. If you miss more than one workgroup session it is no longer possible to pass the project part of the course.

Attendance to the lectures is highly recommended. In our experience, relying on self-study alone is insufficient to apply the theory of the lectures in the assignments of the workgroups, and to pass the exam.

course coordinator: Marlous Arentshorst - m.e.arentshorst@vu.nl

Researching science research

Course code	X_432849 ()
Period	Period 4+5
Credits	12.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	prof. dr. ir. B.A.G. Bossink
Examinator	prof. dr. ir. B.A.G. Bossink
Teaching staff	prof. dr. ir. B.A.G. Bossink
Teaching method(s)	Seminar
Level	500

Course objective
To study strategy, structure, culture and the environment of a lab research group or R&D group in practice. Students learn how a lab research group or R&D group in life & health practice or energy & sustainability practice functions, on a daily basis, on a yearly basis, related to other commercial functions in its direct environment, and related to the strategy of the organization in which it is situated.

Course content
Road mapping-assignment to study strategy, structure, culture and environment of a lab research group or R&D group in life & health practice or energy & sustainability practice.
- Students learn to develop a case study research plan that enables them to study a lab or R&D group in practice
- Students learn to carry out the planned case study research steps
- Students develop an report in which they describe and discuss strategy, structure, culture of a lab research or R&D group in practice
- Students learn to orally present and discuss their finding with a student-audience.

Form of tuition
- Weekly interactive assignment sessions;
- Plenary presentation sessions;

Type of assessment
Students work on an assignment and write a report on the functioning of a lab group or R&D group they studied by means of a case study research method. The assignment is related to 12 EC of the track courses a student has chosen in his/her personal education plan. To pass a weighted average of 5.5 or higher should be scored for the assignment (60%) and presentations (40%).

Course reading
To be announced on blackboard.

Entry requirements
12 EC of science courses

Target group
Master SBI, track Life & Health and Energy & Sustainability

SBI Project & Master Thesis

Course code	X_432735 ()
Period	Ac. Year (September)
Credits	36.0
Language of tuition	Dutch
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	prof. dr. ir. B.A.G. Bossink
Examinator	prof. dr. ir. B.A.G. Bossink
Teaching method(s)	Lecture
Level	600

Course objective
The aim of the Master project is that the individual student learns to conduct a comprehensive SBI research project.

Course content
Further deepening and application of knowledge and skills that are obtained during the bachelor and master program. The project starts with developing a project plan. The plan consists of: literature study, research questions, research methods and techniques, time schedule and research goals. The project starts when the plan is approved by the supervisors from VU University and the supervisor from the organization in which the student conducts the research project. The research project lasts for five to six months, and is centered around a SBI-related problem that is acknowledged by the student and the supervisors. The student produces two deliverables:
a. A thesis, consisting of scientific research design, results, discussion, and conclusions.
b. A report describing the organization in which the project is conducted.

Form of tuition
For further information see Manual Master project SBI (Blackboard). Student will spend most of his/her time on conducting the research project and writing the thesis. Additionally, some time will also be spent on contributing to practical work in the organization that enables the research project. Internship, thesis, final presentation

Type of assessment
Work execution: 40%
Aptitude test (the thesis): 45%
Final oral presentation: 15%

Course reading
Verschuren, P., Doorewaard, H. (most recent edition) Designing a research project. The Hague: Eleven International Publishing.

Other literature as described in the plan of action.

Entry requirements
Up-to-date PEP signed by the master coordinator and the examination board. Maximum of 12 EC open, master project excluded, at the start of the internship.

Target group
2 M SBI

Remarks
A mandatory part of the Master project is the writing of a reflection report. This reflection consists of two parts: a business analysis and self-reflection. The student has to write the report when the internship is (almost) completed.

SBI Research Methodology

Course code	X_432846 ()
Period	Ac. Year (September)

Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. P.C. van der Sijde
Examinator	dr. P.C. van der Sijde
Teaching method(s)	Lecture
Level	500

Course objective
The objective of the course is to learn about the different methodological traditions in science. SBI is a multidisciplinary study in which (natural) sciences, social and business studies are combined. Each with its own pedigree. The students learn about the similarities and differences and how to cope with methodological issues in their research projects.

Course content
The students are introduced to the different methodological traditions (- natural - sciences, social and business studies) and learn about what it means to do research. Students learn to analyze articles, formulate research question, qualitative and quantitative research, setting up research and analyzing data.

Form of tuition
The course has two parts:
Part 1 - classes and workgroups. theory is introduced in the classes and via assignment elaborated in work groups.
Part 2 - the students coach Bachelorstudents in writing their Plan of Action for the Bachelorthesis.

Type of assessment
1. Exam (30%)
2. Research plan for a project (50%)
3. Reflection report of the coaching of Bachelor students (20%)

Course reading
Bhattachjee, A. (2012) Social science research. (Available via Internet)
Selected articles to be announced

Target group
SBI students preparing for their thesisproject

Registration procedure
via the normal procedures

Science and Communication

Course code	AM_470587 ()
Period	Period 1
Credits	6.0
Language of tuition	English
Faculty	Fac. der Aard- en Levenswetenschappen
Coordinator	P. Klaassen MA
Examinator	P. Klaassen MA

Teaching staff	dr. B.J. Regeer, dr. J.F.H. Kupper, drs. ir. M.G. van der Meij, P. Klaassen MA
Teaching method(s)	Lecture, Study Group
Level	500

Course objective
- Gain theoretical insight in the relationship between science and society,
- Gain insight in the role of science communication in this relationship,
- Acquire knowledge of different theories and models of science communication,
- Acquire knowledge of different strategies, media and activities for science communication,
- Learn how to apply theoretical concepts to real-life examples,
- Development of practical skills for science communication (e.g. writing, discussing).

Course content
Science is all around us and shapes our lives in many different ways. From the vaccines you need for travelling abroad, to the technological devices you use on a daily basis. At the same time, society shapes the development of science and technology. Science and society influence each other continuously; they communicate. Students of Science Communication are expected to become experts in understanding and designing interaction between science and society. In order for this interaction to be fruitful and valuable for both science and society, it is important to gain in-depth knowledge about the theoretical basis of the field of science communication and understand communication processes at the core of several interfaces; e.g. the communication between scientists from different disciplines, between different sciences and their stakeholders, and between science and the public. This course provides a broad basis in the field of science communication by addressing the main areas of science communication and by discussing and challenging several core concepts within this field. Students are invited to explore some issues in greater depth and active participation in lectures and workgroups is required.

Form of tuition
Lectures (22 h)
Workgroups (18 h)
Home-study for group assignments (8 h)
Home-study for individual assignments/exam (90h)

Type of assessment
Individual assignments (30%), group assignment (10%), examination (60%). For all parts a pass grade needs to be obtained.

Course reading
Academic articles. Direct links to articles will be provided on BlackBoard one month before the beginning of the course.

Target group
The course Science and Communication is a compulsory course for students of the Master specialisation Science Communication (Wetenschapscommunicatie) and is a prerequisite for the internship. Science and Communication is an optional course for students from other

master programs in the health and life sciences.

Science and Society in Historical Perspective

Course code	X_400424 (400424)
Period	Period 4+5
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. D.J. Beckers
Examinator	dr. D.J. Beckers
Teaching staff	dr. D.J. Beckers
Teaching method(s)	Lecture, Seminar
Level	400

Course objective
To increase understanding of the various interactions between mathematics, chemistry, physics, (medical) biology, computer and earth sciences (in general: science) and society during the last two centuries.

Course content
In the last two centuries science has become one of the prime agents in the shaping of modern society. In turn social and political concerns have been equally instrumental in the shaping of the modern scientific enterprise. In this course we will study the changing relationship between science and society in this period in various case studies and from several points of view. We will use literature and source material, most notably (journal and film) advertisements, and the cartoon journal Punch to illustrate these cases. The following themes are addressed: professionalization, science and the public (e.g. the public understanding and appreciation of science); Science as product and agent of modernity (e.g. quantification and standardization as applied to nature and society); Science and politics (e.g. science policies, military and commercial interests, science and ideology), science and education.

Form of tuition
seminar.

Type of assessment
Active participation during the seminar, essay and presentation and a short exam on the topics addressed during the classes.

Course reading
available via blackboard.

Entry requirements
Bachelor degree

Target group
mFEW, mFALW, mFGW

Remarks

More information with the course coordinator: Afdeling Algemene Vorming,
De Boelelaan 1081, kamer U252, d.j.beckers@vu.nl

Science in Dialogue

Course code	AM_1002 ()
Period	Period 2
Credits	6.0
Language of tuition	English
Faculty	Fac. der Aard- en Levenswetenschappen
Coordinator	dr. J.F.H. Kupper
Examinator	dr. J.F.H. Kupper
Teaching staff	dr. J.F.H. Kupper
Teaching method(s)	Study Group, Lecture, Seminar
Level	500

Course objective
To gain knowledge of and insight into:
- the basic concepts and issues in the understanding of science-society interactions, both from a science and technology studies and communication science perspective
- the nature and course of interpersonal and group communication processes relevant to the formal and informal dialogue between science and society
- the nature and form of dialogical science communication, aimed at reflective learning and mutual understanding

To acquire or improve:
- individual skills for effective interpersonal communication
- individual skills for the design and facilitation of the science-society dialogue

Course content
This course examines the public character of scientific controversy and focuses on the communicative aspects of a fruitful science-society dialogue. At the dawn of the 21st century, science, and particularly fields that combine science and engineering such as nanotechnology and synthetic biology, holds a great promise for the progress of our societies. At the same time, these developments are controversial. They lead to a variety of concerns related to risks, benefits and wider moral issues. Nanotechnology creates materials with novel characteristics that help us, but may also contain risks for health and environment. Synthetic biology develops new biological systems that may be very useful, but radically change the nature and meaning of life. Clearly, advances in science do not always match the needs, desires and expectations of society. On the other hand, parts of society might not always appreciate the nature and scope of scientific findings. For a fruitful relationship between science and society, a constructive science-society dialogue is necessary.
This course offers advanced lectures on the basic concepts and issues of dialogical science communication: communication, learning, dialogue, understanding, controversy, democracy. A series of workshops and small group assignments presents communicative tools and spaces such as discussion games, science theatre and multimedia platforms that can be used to design and facilitate science-society interactions. Training

workshops will focus on improving the students' individual communication and facilitation skills. The students' individual learning curve as a science communicator and facilitator is self-evaluated by means of a refle ction report.
Every course week is completed with a mini-exam.

Form of tuition
Lectures (14h), Workgroups (28h), Training workshops (24h), Dialogue presentations (12h), Selfstudy
(remaining hours)

Type of assessment
Group assignment (50%), Take home exam (30%), Reflection report (20%).
All assignments must be passed (grade > 6).

Course reading
Is announced on blackboard one month before start of the course

Target group
Optional course in the MSc specialization Science Communication

Remarks
Independence and a cooperative attitude is expected. Attendance to training workshops is mandatory.

Science in Perspective

Course code	X_437030 ()
Period	Period 4+5
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Level	400

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/19213

Target group
mCh, mPhys

Remarks
Course registration at the UVA is compulsory at least 4 weeks before the start of the semester via https://www.sis.uva.nl

Science Journalism

Course code	AM_471014 ()
Period	Period 2
Credits	6.0
Language of tuition	English
Faculty	Fac. der Aard- en Levenswetenschappen
Coordinator	dr. J.F.H. Kupper
Examinator	dr. J.F.H. Kupper

Teaching staff	dr. J.F.H. Kupper
Teaching method(s)	Lecture, Study Group, Computer lab
Level	500

Course objective
To acquire knowledge of and insight into:
- the concepts, models and issues of science journalism according to contemporary scientific literature
- the criteria for effective science journalism with respect to diverse media
- the representation of science in the media
- the role of science journalism in the use of scientific knowledge in society

To acquire skills in:
- writing popular scientific texts for different genres such as news, background and interview
- science reporting using videos
- designing science communication for different media such as newspaper, radio and internet

Orientation to the professional practice of science journalism

Course content
This course teaches the basic principles of science journalism. A series of interactive lectures reviews both the practical as well as the theoretical aspects of science journalism. Topics that are discussed are the translation of science to a language that is both compelling and understandable, the role of journalism in the interaction between science and society, images of science in the media and the ethics of science journalism. The interactive lectures invite you to take your own defendable position with regard to these issues.
Guest lectures provide insight into the professional practice of science journalists. The guest speakers work as freelancer, editor or producer at diverse science media, such as newspapers (NRC, Volkskrant), magazines (NWT), internet (Noorderlicht) and radio (Labyrint).
Finally, the course trains specific skills that you need as a science journalist, such as popular writing, popular science videos, interviewing, conceptual analysis
and program design.

Form of tuition
Lectures and seminars on theory and practice of science journalism and writing skill training (36h). Considerable time is set aside for performing science journalism in assignments (108h). The assignments are assessed by lecturers and fellow students (peer-review process). Self study (remaining hours).

Type of assessment
Several individual assignments (60%), several small group assignments (40%). All assignments must be passed (grade > 6).

Course reading
Announced on Blackboard one month before start of the course

Target group

All Master students with a Beta-Bachelor degree. Students taking this course as part of their C-specialisation within FALW or FEW will have precedence over other students. Students from other faculties and or universities need to get formal consent from the course coördinator (Frank Kupper) before enrolment.

Remarks
Course is taught in Dutch. More information: f.kupper@vu.nl.

Science Museology

Course code	AM_470590 ()
Period	Period 3
Credits	6.0
Language of tuition	English
Faculty	Fac. der Aard- en Levenswetenschappen
Coordinator	dr. B.J. Regeer
Examinator	dr. B.J. Regeer
Teaching staff	dr. B.J. Regeer, drs. ir. M.G. van der Meij
Teaching method(s)	Lecture, Study Group, Seminar, Fieldwork
Level	500

Course objective
- Gain insight in the role of museum exhibits in the field of science communication.
- Gain insight in the role of science communication concepts in the context of science museums.
- Apply qualitative research methods to design, conduct, and report on a user research project in museum settings.
- Apply theoretical notions of science communication and exhibit design to advise development of exhibit experience and content design.
- Gain experience in working for an external commissioner.

Course content
This course is about the role of science museums/centers, zoos and natural history museums in science communication. You will get familiar with theories of science communication in museum settings, and will be introduced to different styles of communication, different approaches to exhibit design & development, and different methods of research and evaluation of exhibitions.
Guest speakers and lecturers give insight into their profession (1) as science communicators in museums and science centers, (2) as researchers in the field of museology, and/or (3) as professionals in informal science & technology learning environments.
Through individual and group assignments you are encouraged to combine theory and practice, working step-by-step towards (part of) an exhibition (re-)design. The group assignments are commissioned by museums and science centers, such as NEMO, Museon, Naturalis, Delft Science Centre, and Artis.

Form of tuition
Lectures
Workgroups
Workshops
Home-study for group assignments

Home-study for individual assignments
Field work

Type of assessment
Group assignment (50%), presentation (poster and oral) (10%), and individual exam(s) (40%). For the assignments, presentations and all exams a pass-grade must be obtained.

Course reading
Academic articles. Direct links to articles will be provided on Blackboard one month before the beginning of the course.

Entry requirements
It is possible to follow the course as an elective course outside of one of the science communication master specialisations of FALW/FEW. In that case additional reading may be required depending on the student's background.

Target group
Optional course in the Science Communication master specialisation of most of the two-year master programs of the FALW and FEW faculties. Master students from other universities in any scientific field are welcome as well. Additional reading may be required.

Remarks
Guest lectures from and excursions to for instance Artis, NEMO, Naturalis, NorthernLight, Museon, etc.

Science project

Course code	X_422591 ()
Period	Ac. Year (September)
Credits	24.0
Language of tuition	Dutch
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. J.P. Dekker
Examinator	dr. J.P. Dekker
Level	400

Course objective
The MSc SBI students will follow the Science Project SBI to strengthen their knowledge and experience with natural sciences in order to be able to talk the language of the specialists and to scan and interpret new developments and inventions in the field of life and health and/or energy and sustainability. The student will:
a. actively participate in a research team and is expected to critically follow and discuss research matters that are a subject in meetings as well as present his or her own work to the group on a regular basis. In doing so and through this immersion in faculty research, the student is becoming acquainted with a research process, including its organization, objectives and challenges.
b. design, execute and deliver his or her own research project and be individually responsible for it, under supervision of a senior scientist. A second and independent reviewer will be assigned to assess the final products.

c. deliver a final report, present outcomes on a regular basis including a final presentation and make detailed recommendations for further research with respect to his or her research assignment.

Course content
In this project the student should work closely with laboratory researchers on a project based on modeling and/or experimental lab work. Programs that contain innovation or valorization aspects are ideally suited for participation of SBI students. Once a topic has been agreed upon, the student will agree on a research question. Subsequently the student will draft a research plan in which is addressed: theoretical framework, research methodology and data analysis, experimentation set-up, planning, organization, anticipated outcomes and reporting format. This plan will also include a listing of some relevant literature references pertaining to the particular topic.

The plan may also include a course to provide insight and experience on experimental lab work or modeling. For instance, it is possible to define a drug discovery project that is accompanied by the integrated course Computational Design and Synthesis of Drugs (code 435673). In this course, students will learn step by step about data mining and computer-aided drug design techniques. The study load of these courses will be integrated in the Science Project SBI.

Form of tuition
Research project

Type of assessment
Report and presentation, as explained in the course manual

Course reading
Depending on the project

Entry requirements
Requirements to enter the mSBI program

Target group
mSBI

Scientific Programming

Course code	X_435076 (435076)
Period	Period 2
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	prof. dr. L. Visscher
Examinator	prof. dr. L. Visscher
Teaching staff	prof. dr. L. Visscher
Teaching method(s)	Lecture, Practical
Level	500

Course objective
To instill a broad understanding of how computers are utilized in scientific research, and impart practical skills in scientific

programming and scripting.

Course content
This course gives an introduction to programming in a scientific research context and consists of four modules.
The 'Introduction to Unix/Linux Systems' and the module 'Scientific Scripting with Python' are compulsory. From the two modules on compiled languages the students should choose either 'Scientific Software Development in Fortran'
or 'Introduction to C Programming'.

A brief description of the modules is:

1) Introduction to Unix/Linux Systems
Includes logging in; directories and files; grep and regular expressions; editing with vi; sed and awk; shells and shell programming.

2) Scientific Software Development in Fortran
Includes flavors of Fortran; compiling; variables and data types; procedures; reading/writing data; arrays; control statements; modules; user-defined types; structured programming with abstract data types (ADTs); introduction to concepts in software design.

3) Introduction to C Programming
Includes compiling with gcc; variables; control structures (e.g. loops); data types and functions; input/output; pointers; basic algorithms.

4) Scientific Scripting with Python
Includes introduction to scripting and automation; introduction to Python; running scripts; loading modules; variables; functions; opening/closing files; reading data; extracting data from strings; writing data; running external programs; working with structured data (eg XML, SQL databases); classes and object-oriented programming.

Form of tuition
Lectures, exercise sessions and self study.

Type of assessment
Each module will be assessed separately.
Assessment requires completion of assignments for each module taken.

Course reading
Course notes will be provided. Some online resources will be used.

Recommended background knowledge
None.

Target group
Master students that would like to automate the generation and/or processing of scientific data. This need not be restricted to students in theoretical fields: experimentalists can also benefit from computing skills, especially for the analysis and processing of experimental data.

Separation Sciences

Course code	X_435609 (435609)
Period	Period 1

Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. H. Lingeman
Examinator	dr. H. Lingeman
Teaching staff	dr. H. Lingeman
Teaching method(s)	Lecture
Level	400

Course objective
Getting acquainted with the theory and practice of the main techniques in modern analytical separation science.

Course content
The topics discussed comprise the fundamentals, theory and practice of gas chromatography, the various modes of liquid chromatography, capillary-based electrophoretic approaches as well as the hyphenation of the various separation systems with mass spectrometry and other sensitive and selective detection devices.

Form of tuition
Lectures and tutorials. Students have to summarize and present an (assigned) recent article on separation science.

Type of assessment
Written examination and a mark for the article presentation.

Course reading
Hands-outs (electronically available).

Entry requirements
Basic knowledge of biochemistry, chromatography, electrophoresis and mass spectrometry.

Recommended background knowledge
Basic knowledge of biochemistry, chromatography, electrophoresis and mass spectrometry.

Target group
mCh-AS

Soft Condensed Matter and Biological Physics

Course code	X_420167 (420167)
Period	Period 2
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	prof. dr. ir. G.J.L. Wuite
Examinator	prof. dr. ir. G.J.L. Wuite
Teaching staff	prof. dr. ir. G.J.L. Wuite, prof. dr. P.R. ten Wolde
Teaching method(s)	Lecture

Level	400

Course objective
To provide insight into the physics of biological systems and soft condensed matter. In addition we will discuss and illustrate recent examples of the scientific literature in this field.

Course content
- The building blocks of cells.
- Statistical physics applied to soft-condensed matter.
- Random Walks, Friction and Diffusion.
- Life at low Reynolds number.
- Entropic forces at work.
- Chemical forces & self-assembly.
- The cytoskeleton, a semiflexible, crosslinked polymer network.
- Enzymes and molecular machines.
- Molecular motor proteins, the lorrries in our cells.

Form of tuition
Lectures, and self-study.

Type of assessment
Homework, Scientific literature presentations and an exam.

Course reading
Nelson, P., Biological Physics, Energy, Information, Life. New York: W.H. Freeman and Company, 2004 (ISBN 0-7167-4372-8).
Later editions are also fine.

Target group
mMNS, mPhys-AMEP, mPhys-PLH

Specialisation

Course code	O_MLVERD ()
Period	Period 2+3
Credits	3.0
Faculty	Fac. der Gedrags- en Bewegingswetensch.
Coordinator	dr. A. Handelzalts
Examinator	dr. A. Handelzalts
Teaching staff	drs. J.K.W. Riksen, drs. H.R. Goudsmit, drs. Y.G. Meindersma, drs. W.S. Hoekstra, drs. S. Donszelmann, dr. H.B. Westbroek, C.L. Geraedts, drs. A. Krijgsman, drs. K.L. Schaap, W. Maas, F.L. de Vries MSc, drs. H. Stouthart, drs. I. Pauw, drs. C.D.P. van Oeveren
Teaching method(s)	Seminar,
Level	500

Statistical Theory of Complex Molecular Systems

Course code	X_428520 (428520)
Period	Period 1
Credits	6.0

Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Level	400

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/17065

Remarks
This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100. Enrolment via https://m.sis.uva.nl/vakaanmelden is required.

Supramolecular Chemistry and Nanomaterials

Course code	X_435653 (435653)
Period	Period 1
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Teaching method(s)	Lecture
Level	400

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/15036

Remarks
This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100. Enrolment via https://m.sis.uva.nl/vakaanmelden is required.

Synthetic Organic Chemistry

Course code	X_435665 (435665)
Period	Period 4
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Level	500

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/15032

Remarks
This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100. Enrolment via https://m.sis.uva.nl/vakaanmelden is required.

Teaching Assistant

Course code	X_432741 ()
Period	Ac. Year (September)
Credits	3.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. J.E. van Muijlwijk-Koezen
Examinator	prof. dr. ir. R.V.A. Orru
Level	400

Teaching Assistant

Course code	X_432742 ()
Period	Ac. Year (September)
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. J.E. van Muijlwijk-Koezen
Examinator	prof. dr. ir. R.V.A. Orru
Level	400

Teaching Methodology Chemistry I

Course code	O_MLVDSKI ()
Period	Period 1+2
Credits	3.0
Language of tuition	Dutch
Faculty	Fac. der Gedrags- en Bewegingswetensch.
Coordinator	dr. H.B. Westbroek
Examinator	dr. H.B. Westbroek
Teaching staff	dr. H.B. Westbroek, F.L. de Vries MSc
Teaching method(s)	Seminar
Level	500

Teaching Methodology Chemistry II

Course code	O_MLVDSKII ()
Period	Period 1+2
Credits	6.0
Faculty	Fac. der Gedrags- en Bewegingswetensch.
Coordinator	dr. H.B. Westbroek
Examinator	dr. H.B. Westbroek
Teaching staff	dr. H.B. Westbroek, F.L. de Vries MSc
Teaching method(s)	Seminar
Level	500

Teaching Practice I

Course code	O_MLPRAKI ()
Period	Period 1+2+3
Credits	15.0
Faculty	Fac. der Gedrags- en Bewegingswetensch.
Coordinator	ir. E.J.F. Scheringa
Examinator	ir. E.J.F. Scheringa
Level	500

Teaching Practice II

Course code	O_MLPRAKII ()
Period	Period 1+2+3
Credits	15.0
Faculty	Fac. der Gedrags- en Bewegingswetensch.
Coordinator	ir. E.J.F. Scheringa
Examinator	ir. E.J.F. Scheringa
Level	500

Technology and Innovation Processes

Course code	E_BA_TIP ()
Period	Period 2
Credits	6.0
Language of tuition	English
Faculty	Fac. der Economische Wet. en Bedrijfsk.
Coordinator	dr. P.R. Tuertscher
Examinator	dr. P.R. Tuertscher
Teaching method(s)	Lecture, Study Group
Level	400

Course objective
After finishing this course, students will be able to:
• Explain challenges, concepts, and theories related to processes of technological innovation
• Apply concepts and theories to analyze real life cases and develop solutions to improve innovation processes
• Critically reflect upon theoretical assumptions and methodological approaches in research on technology and innovation

Course content
This course is about processes of technological innovation within and between organizations. In short, this course concerns the creation of innovative ideas and their conversion into products and services that have value for a company and its customers. This course helps students to understand and improve the complex and uncertain process of

technological innovation. Topics that will be addressed include the evolution of technology, collaborative innovation, uncertainty and learning, business model innovation, the role of the institutional contexts, and timing in innovation processes. The course will focus on specific fields of technology: energy, information technology, life sciences / biotech, and semiconductors.

Form of tuition
The course will consist of a combination of interactive lectures (6), seminars (6), and assignments. The lectures will also include a critical discussion of selected readings, stimulated by obligatory individual reflections on this literature. The seminars will be used to have groups of students present and discuss assignments.

Type of assessment
Students will be graded based upon three types of assignments:
• Individual reflections on literature
• Group assignments based on real life cases
• Final group assignment in which theoretical perspectives have to be applied to a specific technological innovation

Course reading
A collection of scientific articles, to be announced on Blackboard.

Recommended background knowledge
Basic knowledge of innovation management and organization studies

The analytical Chemist in Industry

Course code	X_437005 (437005)
Period	Period 4
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Examinator	prof. dr. ir. R.V.A. Orru
Level	400

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/15046

Remarks
This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.
Enrolment via https://m.sis.uva.nl/vakaanmelden is required.

Transdisciplinarity and Transition

Course code	X_430604 ()
Period	Period 2
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	prof. dr. J.T. de Cock Buning

Examinator	prof. dr. J.T. de Cock Buning
Teaching staff	prof. dr. J.T. de Cock Buning
Teaching method(s)	Lecture, Seminar, , Study Group
Level	400

Course objective
• You can reproduce and apply the essence of current transition theories, e.g. the multi-level perspective.
• You can design a tailor made transdisciplinary approach to identify and cope with hurdles in an innovation trajectory, based on amongst others the Interactive Learning and Action approach.
• You are able to make an in-depth semi-structured interview guide.
• You are able to execute, transcribe, analyse and summarise an in-depth interview.
• You are able to apply analytical tools, such as causal analysis, actor analysis, fact-value framing, SWOT.
• Your are able to integrate multi-disciplinary knowledge and multi-stakeholder interests into a management advice for a transition process.

Course content
Innovation often implies a troublesome and risky process starting with a bright idea, via a small niche innovation towards a competitive position. This course focuses on the analytical skills necessary to guide and advice a niche innovation.

Guiding and advising implies that you are aware of the social forces prohibiting a breakthrough and how to identify and implement tailor made solutions to deal with these forces. Therefore, this course introduces you to several theories related to innovation and societal forces, and we will offer you training with a toolbox of various analytical methods to explore the specific hurdles of a given project, in order to design a tailor made advice.

Little by little, academic research reveals the complexity of societal mechanisms behind transitions, e.g., cultural aspects, psychological aspects, structures of states, institutions and multinationals. Transdisciplinarity is an emerging discipline in which research approaches and analytical methods are developed to connect relevant parts of different disciplines to solve complex processes, including transitions. Transitions are referred to as complex because different stakeholder groups are involved (e.g. industry, academia, consumers and NGOs) and these stakeholders often have different visions on what is "best" for society.

On the basis of experiences with large innovative consortia (Genomic Initiative - ecological genomics, Sustainable innovation/brain imaging, BE-Basic/synthetic biology) you will learn all about the do’s and don’ts of the Interactive learning and Action approach, how to use an actor analysis to delineate you allies and enemies, how to use semi-structured interviews to deepen your understanding of reasons behind problems, how to construct a causal analysis to understand the complexity of the problems you face, and how a SWOT analysis can help to identify strategic priorities.

Parallel to the lectures you will work in a group on an advice regarding an innovation, conducting interviews with key players and analysing the complexity of interests.

Form of tuition
The total study time is 6 EC (6x28 = 168 hours). Tuition methods include lectures, training sessions, self-study, and a group project on a specific case. In the case study, you will integrate different theories and tools, and apply the toolbox introduced during the lectures.
- lectures 12 hours
- coach meetings 16 hours
- skills training 6 hours
- execution of 2 interviews 2 hours
- execution expert meeting 2 hours
- presentation of project results 4 hours
- self study and project 124 hours
- examination 2 hours (two mini-exams of 60 minutes)

Please note that attendance to the project meetings is compulsory. For the group project, you will make rules with your group during the first meeting with your coach.

Type of assessment
The course grade is based on the project (group and individual) and the exam. All aspects (including both mini-exams) have to be concluded with the grade of 5.5 or higher.

Team project report (40%)
Team project presentation (10%)
Individual attitude and skills assessment (20%)
2 individual written mini-exams (30%)

Course reading
Book: Biotechnology and Food
Articles are made available via Blackboard

Entry requirements
Proven knowledge of organisations and management and business is required

Target group
Master students SBI track (mCh)

Registration procedure
As the number of participants will dictate the number of different projects (and the related team coaches), the deadline for VU-net registration will be 4 weeks before the start of the course. Retracting your registration for the course after the deadline will have detrimental effects on the composition of the teams, the network of contacted interviewees and contracted coaches.

Remarks
This course mimics the world of a transition task-force. This implies 100% use of the available time (=20 hours a week) to accomplish all the necessary steps in conceptualisation of the complexity, data collection, interviews, analysis, validation of pre-liminary result with external experts, and finally presenting your change strategy. You will need to use and integrate all knowledge you acquired before.

Transport Phenomena

Course code	X_420075 (420075)
Period	Period 4+5
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Level	500

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/15017

Remarks
This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.
Enrolment via https://m.sis.uva.nl/vakaanmelden is required.

Tutoring Students

Course code	X_432625 (432625)
Period	Period 2
Credits	3.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. M. Wijtmans
Examinator	dr. M. Wijtmans
Teaching staff	dr. M. Wijtmans, dr. H.B. Westbroek
Teaching method(s)	Lecture
Level	400

Course objective
This course aims to prepare students for coaching tasks in tutorials and practical courses. Students will encounter aspects of teacher-student interaction, including several models that are involved in the coaching process.

Course content
The course contains various topics and activities. Students make an analysis of various learning aims as well as prepare, conduct and reflect on a presentation of a pre and post discussion regarding tutorials and practical courses. They will observe and interpret the application of problem solving and coaching models in tutorials and practical courses. Attention will be paid to strengths and weaknesses in models of teacher-student interaction. An important constituent is the student's analysis of his/her own pattern of communication. Topics on safety and lab journal procedures in practical courses as well as on the grading of lab reports are also included.

Form of tuition
4 consecutive hours per week (seven weeks long):
- Lectures
- Simulations
- Self-study
- Group work

Type of assessment
- An essay on the strengths and weaknesses in a model of teacher-student interaction.
- A learning report on presentations concerning predict, observe, explain in practical work.
- A written analysis on grading lab reports.
- A written feedback on the planning of and enactment in tutorials.

Course reading
Will be provided.

Target group
mCh-AS, mCh-MDSC, mCh-MSP, mCh-SES, mDDS-BCCA, mDDS-CMCT, mDDS-DD&S, mDDS-DDSA, mDDS-DDTF

Registration procedure
VUnet

Remarks
This course is compulsory for MSc students who become assistants in practical courses and tutorials in the department of Chemistry and Pharmaceutical Sciences. Moreover, the course is recommendable for any MSc student who has a general interest in educational coaching strategies and models.

Number of participants is limited to 24 (first-come, first-serve basis).

Priority is given to MSc students. If any of the 24 seats are left, the course may also be accessible to 3rd year BSc students FAR en SK with a strong interest in educational aspects (first-come, first-serve basis). Interested BSc students should first contact Maikel Wijtmans (m.wijtmans@vu.nl).

Ultrafast Laser Physics

Course code	X_422556 (422556)
Period	Period 4
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	prof. dr. K.S.E. Eikema
Examinator	prof. dr. K.S.E. Eikema
Teaching staff	prof. dr. K.S.E. Eikema
Teaching method(s)	Lecture
Level	400

Course objective
To provide a broad overview of both the ultrafast techniques and phenomena in physics and chemistry.

Course content
This course covers both the principles behind ultrafast optical pulse generation and control, and its applications in physics and chemistry. After a review of basic femtosecond laser techniques, the interaction

of light with matter in the linear and nonlinear regime will be discussed. This includes the concepts of dispersion (in 1st and higher order) and pulse propagation effects, nonlinear processes such as second-harmonic generation, parametric amplification, stimulated Raman scattering, photon echos. Also pump-probe and transient spectroscopy with be discussed. Other topics that will be covered are pulse measurement techniques such as FROG and SPIDER, femtosecond frequency combs, spectrum extension methods such as continuum, THz and X-ray generation, attosecond physics, spectral and temporal shaping of pulses, including applications such as coherent control. These concepts will be illustrated using applications in physics and chemistry.

Form of tuition
Lectures with excersices and demonstrations (excursions to the lab).

Type of assessment
Written exam.

Course reading
Lecture notes and papers.
Recommended book: "Ultrashort Laser Pulse Phenomena" by J-C Diels and W. Rudolph, 2nd
edition (2005), ISBN 978-0-12-215493-5

Recommended background knowledge
Some background in optics and electrodynamics is required.

Target group
Master students physics.

Remarks
Please make sure the study guide shows the right length of the lectures: it is 3 hours per lecture (NOT 4 as mistakenly written in the current schedule for period 5 in 2015!!!).

Understanding Molecular Simulation

Course code	X_432703 (432703)
Period	Period 3
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Level	400

Course content
http://studiegids.uva.nl/xmlpages/page/2015-2016/zoek-vak/vak/15302

Remarks
This course is offered at the UvA. For more information contact: FNWI Education Service Centre, Science Park 904, servicedesk-esc-science@uva.nl, +31 (0)20 525 7100.
Enrolment via https://m.sis.uva.nl/vakaanmelden is required.

Understanding Quantum Chemistry

Course code	X_422557 (422557)
Period	Period 2
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	prof. dr. L. Visscher
Examinator	prof. dr. L. Visscher
Teaching staff	prof. dr. L. Visscher
Teaching method(s)	Lecture
Level	400

Course objective
Introduce the electronic structure methods commonly employed in computational chemistry and physics.

Course content
The course starts with the introduction of the independent particle model and the consequences of the Pauli principle. The Hartree-Fock approach is introduced and the Slater-Condon rules are derived to treat multideterminant wave functions. This forms the basis for discussion of the more sophisticated wave functions used in Configuration Interaction, Møller-Plesset perturbation theory and Coupled Cluster expansions. The alternative way to deal with electron correlation, Density Functional Theory, is also discussed in detail. These methods are illustrated with exercises in which the students learn to apply modern electronic structure software.

Form of tuition
The course comprises sessions of lecture-exercises-lecture that are scheduled twice a week. These sessions serve to cover the theory that is to be mastered by all students. In the practical sessions students will work on exercises during which the theory is applied on representative case studies using computational chemistry software.

Type of assessment
Written exam and computer exercises.

Course reading
Atkins and Friedman, Molecular Quantum Mechanics 4th ed. or later, Oxford
University Press.
Jensen, F., Introduction to Computational Chemistry 2nd ed. or later Wiley, 2007.
Hand-outs.

Target group
mPhys-LSBP, mCh-MSP

Remarks
Optional course (2 out of 4 choice) in the Master of Chemistry / Molecular Simulation and Photonics track.