Track Science, Business & Innovation

VU University Amsterdam - Faculteit der Exacte Wetenschappen - M Chemistry (joint degree) - 2016-2017

The curriculum in this Master’s programme mainly takes place at the University of Amsterdam. For in-depth information about the structure and the courses, please visit the website of the University of Amsterdam.

The specialization Science, Business and Innovation mainly takes place at the Vrije Universiteit Amsterdam. More information about the structure and the courses can be found below.

Index

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

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	XM_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	XM_422591

Recommended electives

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	Period 1	6.0	X_432846
Transdisciplinarity and Transition	Period 2	6.0	X_430604

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
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

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
http://studiegids.uva.nl/xmlpages/page/2016-2017-en/search-course

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. For courses taught in period 1 and period 2, enrolment via https://datanose.nl/#specialenrol is required.

Business & Innovation Project

Course code	XM_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, 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;

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 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 or Chemistry.

With a BSc SBI or Chemistry, please contact prof. Leurs before registration on your eligibility to participate.

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.

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 content
http://studiegids.uva.nl/xmlpages/page/2016-2017-en/search-course

Remarks
This course is part of the MSc Physics and Astronomy (joint degree) and 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 content
http://studiegids.uva.nl/xmlpages/page/2016-2017-en/search-course

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.
For courses taught in period 1 and period 2, enrolment via https://datanose.nl/#specialenrol 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 content
http://studiegids.uva.nl/xmlpages/page/2016-2017-en/search-course

Remarks
This course is part of the MSc Physics and Astronomy (joint degree) and 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.

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 content
http://studiegids.uva.nl/xmlpages/page/2016-2017-en/search-course

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. For courses taught in period 1 and period 2, enrolment via https://datanose.nl/#specialenrol is required.

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

Networked Organizations and Communication

Course code	S_NOC ()
Period	Period 2
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Sociale Wetenschappen
Examinator	dr. A. Nerghes
Teaching staff	dr. C. Moser
Teaching method(s)	Lecture, Study Group
Level	600

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 network software tool to conduct social and semantic network analysis, and reflect on the results.

Course content
The seminar Networked Organizations and Communication aims at gaining in-depth insight into networked organizations 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 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.

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, en advies en verandering, exchange students, and students SBI.

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 content
http://studiegids.uva.nl/xmlpages/page/2016-2017-en/search-course

Remarks
This course is part of the MSc Physics and Astronomy (joint degree) and 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.

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

Target group
mCh-SES, mPhys-SES, mSBI

Remarks
This course is part of the MSc Chemistry (joint degree) and 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.

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, dr. J.N.M. Commandeur, dr. D. Bald, dr. ir. K.A. Feenstra, prof. dr. M.J. Smit, dr. D.P. Geerke, prof. dr. ir. E.J.G. Peterman
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

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	E.H. Kroezinga
Examinator	prof. dr. ir. B.A.G. Bossink
Teaching staff	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	Period 1
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	prof. dr. P.C. van der Sijde
Examinator	prof. 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 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
Master students in the sciences who enjoy history or (historical) reflection on their field of subject, as well as master students in history, who want to acquire more understanding in the role of science in society.

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

Science project

Course code	XM_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

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

Transdisciplinarity and Transition

Course code	X_430604 ()
Period	Period 2
Credits	6.0
Language of tuition	English
Faculty	Faculteit der Exacte Wetenschappen
Coordinator	dr. O.E. Popa
Examinator	dr. O.E. Popa
Teaching staff	dr. B.J. Regeer
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
Lectures, skills training, coach meetings, self-study and project
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 of 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 (coach meetings and skills training) is compulsory. Attendance to the lectures is highly recommended since relying on self-study alone has proven to be insufficient to pass the mini-exams. 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%)
Resits for the mini-exams will be organized in the first resit period after the end of the course (February).

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 preliminary result with external experts, and finally presenting your change strategy. You will need to use and integrate all knowledge you acquired before.