UNIVERSITY OF AMSTERDAM

FACULTY OF SCIENCE

TEACHING AND EXAMINATION REGULATIONS
PART B

Academic year 2017-2018

MASTER'S PROGRAMME MATHEMATICS

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Chapter 1. General Provisions

Article 1.1 – Definitions

In addition to part A, the following definitions are used in part B

a. Personal Education Plan: An individual study plan for the student's master programme.
b. Master Project: Compulsory internship/master thesis of 30-60 EC always resulting in a written report

Article 1.2 – General information master's programme

The Master's programme Mathematics, CROHO 66980, is offered on a full-time basis. The language of instruction for the programme is English. This means that the Code of Conduct governing Foreign Languages at the UvA and the provisions laid down in Section 7.2 of the Act apply.

1. The programme has a workload of 120 EC. The study programme is offered in collaboration with all Dutch universities that participate in Mastermath.
2. Students choose between a regular programme and programmes with a major or minor. Each major and minor has its specific exit qualifications.
3. The student may choose a major or a minor from the list below (see Article 4.1).
    - Major Science in Society;
    - Major Science Communication;
    - Major Teaching;
    - Minor Tesla.
    - Minor Teaching

Article 1.3 – Enrolment

Students may enrol to start the programme at the beginning of the first and second semester of the study year (September and February).

Chapter 2. Aim of the programme and exit qualifications

Article 2.1 – Aim of the programme

The aim of the programme is:

a) The objectives of the Master's programme are to provide students with knowledge, abilities and insight in the field of mathematics, to enable them to work as an academic professional, or to become qualified to pursue advanced training as scientific researcher.
b) The programme also aims at furthering the understanding of the position and role of mathematics in the sciences and in society, and to further a sense of social responsibility.

Article 2.2 – Exit qualifications

1. The student graduating from the programme:

a) has a thorough theoretical and practical knowledge of mathematics, including the knowledge of other disciplines required for that purpose;
b) has insight in the development and heuristics of modern mathematics;
c) has sufficient knowledge and research experience in at least one sub-area within the mathematics discipline;
d) is able to formulate a research plan, based on a relevant problem within the mathematics discipline;

e) is able to analyse and formulate research results and to draw conclusions from them;
f) is able to write a scientific report;
g) is able to participate in discussions about mathematical problems with fellow researchers;
h) is able to consult (international) professional literature in the relevant sub-areas and to apply the knowledge gained from that;
i) is able to apply one's knowledge of mathematics in a broader (multidisciplinary) context;
j) is employable in those positions in which knowledge and research skills in the field of mathematics are a prerequisite;
k) has in depth knowledge of, and insight in the social role of mathematics to make sound choices regarding one's own profession, as well as in the exertion of this profession;
l) is able to cooperate with other people, to convey knowledge to other people and to give a presentation both to discipline specialists and to a broader audience.

2. In addition to paragraph 1, the student finishing the regular programme described in Article 4.1 is able to:

m) place the obtained results and conclusions in the context of the results obtained by other scientists;
n) carry out literature research in mathematics from various sources, and combine and enrich these with one's own contribution;
o) develop a vision on the development of scientific research in the field of study.

Chapter 3. Admission to the programme

Article 3.1 – Entry requirements

1. Students who have successfully completed a Bachelor's degree *Wiskund*e awarded by a Dutch University may be admitted.
2. Students who have successfully completed a Bachelor's degree *Beta-gamma met een Wiskunde major*, awarded by the University of Amsterdam may be admitted.
3. Without prejudice to the provisions of paragraph 1, the Admissions Board may grant admission to the study programme when concluding that the previous education of the candidate is equivalent to the Bachelor's degree referred to in paragraph 1.

Article 3.2 – Premaster's programme

Without prejudice to the provisions of Article 3.1 the Admissions Board may grant admission to a student whose previous education does not meet aforementioned admission requirements to the study programme, when concluding that the candidate is able to meet these admission requirements within a reasonable period of time. At the request of a candidate, and when the Admissions Board has decided additional education feasible, the Admissions Board may draw up a programme of at most 30 EC as an admission requirement, a so called `Premaster's programme'. After completion of this Premaster's programme a letter of admission will be issued, exclusively for the stated Master's programme.

Article 3.3 – Restrictions on the number of students admitted to the Master's programme

Not applicable.

Article 3.4 – Intake dates

A request for admission to the Master's programme starting in September must be received before 1 May in the case of EU students (including Dutch students) and before 1 February in the case of non-EU students. For the programme starting in February, applications must be received

before 1 December for EU students (including Dutch students) and before 1 October for non-EU students. Under exceptional circumstances, the Admissions Board may consider a request submitted after these intake dates.

Article 3.5 – English Language Requirements

1. Admission to the programme requires sufficient command of the English language. A student may take one of the following tests to demonstrate language competence:
   - IELTS: 6.5
   - TOEFL: paper based test: 580
   - TOEFL internet based test: 92
   - Cambridge Advanced English: C
2. Those possessing command of the English language at the VWO level satisfy the English Language Requirement.

Article 3.6 – Free curriculum

1. The student may compile a curriculum of his/her own choice which must be approved by the Examinations Board.
2. At least one half of the proposed curriculum must consist of components of the regular programme, including the Master Project Mathematics.

Chapter 4. Content and organisation of the programme

Article 4.1 – Organisation of the programme

1. The curriculum comprises the following:

Components	**Regular programme**	**Programme with Major**	**Programme with Minor**
Master Seminar	6 EC		6 EC
Constrained electives	66 EC	36 EC	48 EC
Master Project Mathematics	36 EC	24 EC	24 EC
Free elective components	12 EC		12 EC
Major/minor programme		60 EC	30 EC
Total EC	**120 EC**	**120 EC**	**120 EC**

In consultation with the coordinator of the Master's programme the contents of the study programme will be determined. These contents are laid down in a Personal Education Programme (PEP). Students submit their study programme (PEP) for approval to the Examinations Board.

2. The student can choose between the regular programme and a programme containing one of three majors or one of two minors. The majors and minors are:
   a. Major Science in Society;
   b. Major Science Communication;
   c. Major Teaching;
   d. Minor Tesla.

e. Minor Teaching

3. Regarding the majors:
   A major consists of 60 EC. It must be combined with a research programme, comprising at least 60 EC credits as listed in the table in paragraph 1 in order to meet the general requirements of the programme. Students have to go through a separate intake procedure for admission to one of the majors. Students first have to finish the obligatory research part of the programme before starting one of the majors. The exit qualifications of the majors can be found in appendix 1.
4. Regarding the major Teaching:
   The major Teaching consists of the *Lerarenopleiding Wiskunde* offered by the *Interfacultaire Lerarenopleidingen*. Students who have completed the *Educatieve Minor* of 30 EC credits during their Bachelor's programme may submit a non-standard study programme for approval to the Examinations Board. The non-standard study programme contains 30 EC credits from the *Lerarenopleiding Wiskunde* at the *Interfacultaire Lerarenopleidingen,* combined with a research programme comprising at least 90 EC credits. The components of the *Lerarenopleiding* are listed in the Course Catalogue.
5. Regarding the minor Tesla:
   The minor Tesla consists of 30 EC credits. It must be combined with a research programme, comprising at least 90 EC credits as listed in the table in paragraph 1 in order to meet the general requirements of the programme. Students have to go through a separate intake procedure for admission to the minor. The learning objectives of this minor can be found as in appendix 1.
6. Students of the regular programme choose one of four specializations. The specializations are
   a. Algebra and Geometry,
   b. Mathematical Physics,
   c. Analysis and Dynamical Systems,
   d. Stochastics.

   In their first year, students take the Master Seminar in their chosen specialization.
   Depending on the chosen specialization the choice of constrained electives is restricted as described below.
   a. Algebra and Geometry
      Students take at least three courses from the following list:
      - Algebraic Topology
      - Algebraic Geometry 1
      - Riemann Surfaces
      - Lie Groups and Lie Algebras
      - Quivers
      - Algebraic Methods in Combinatorics

      Students take at least two courses from the list of advanced courses. For 2017/18 the list is
      - Advanced Algebraic Geometry: Algebraic Surfaces
      - Advanced Combinatorics
      - Advanced Hamiltonian Dynamics
      - Poisson Geometry
      - TFT and Moduli Spaces
      - Algebraic Geometry 2
      - Algebraic Topology 2
      - Quantum Groups and Integrable Systems

- Topology in Physics

b. Mathematical Physics

Students take at least three courses from the following list:

- Differential Geometry
- Algebraic Geometry 1
- Algebraic Topology
- Lie Groups and Lie Algebras
- Riemann Surfaces

Students take at least two courses from the following list:

- Statistical Physics and Condensed Matter Theory I
- Quantum Field Theory
- String Theory

Students take at least two courses from the list of advanced courses. For 2017/18 the list is

- Poisson Geometry
- TFT and Moduli Spaces
- Quantum Groups and Integrable Systems
- Foundations of General Relativity
- Topology in Physics

c. Analysis and Dynamical Systems.

Students take at least three courses from the following list

- Functional Analysis
- Partial Differential Equations
- Dynamical Systems
- Finite Element Methods for Partial Differential Equations (will be taught again in 2018/19)

Students take at least two courses from the list of advanced courses. For 2017/18 the list is:

- Advanced Hamiltonian Dynamics
- Poisson Geometry
- Nonlinear Waves
- Inverse Problems in Imaging
- Topics in Complex Analysis

d. Stochastics.

Students take the following courses

- Measure Theoretic Probability
- Asymptotic Statistics
- Stochastic Processes

Students take at least two courses from the list of advanced courses. For 2017/18 the list is:

- Discrete Choice Analysis: Theory and Application
- Percolation: from Introduction to Frontiers of Current Research
- Portfolio Theory
- Queues & Levy Fluctuation Theory
- Statistics for High-dimensional Data
- Statistical Theory for High- and Infinite-Dimensional Models
- Interest Rate Models

7. Students may submit a non-standard compilation of the regular programme for approval to the Examinations Board, containing courses and a topic of a Master Project Mathematics in a different specialization in the field of mathematics.

Article 4.2 – Compulsory components

1. Master Seminar:
   The content, format, and assessment criteria of Master Seminar in Algebra and Geometry, Master Seminar in Stochastics, Master Seminar in Analysis and Dynamical Systems are described in the Course Catalogue.
2. Master Project Mathematics:
   a. The Master Project Mathematics consists of a thesis, a midterm presentation in the Master Seminar of the specialization of the student, and a final presentation. The thesis contains a short non-specialist summary in either Dutch or English.
   b. At the end of the Master Project Mathematics the supervisor (first examiner) checks on the basis of the assessment criteria, if the student has sufficiently achieved the exit qualifications. The assessment criteria are described in the course catalogue.
   c. In the assessment of the Master Project Mathematics
      i. a staff member will act as a second reviewer;
      ii. the coordinator of the Master Seminar will assess the midterm presentation;
      iii. the final report will be attended by the supervisor and the second reviewer;
      iv. the final grade for the master project will be determined in a private meeting of the supervisor, the second reviewer and a member of the Examinations Board.

Article 4.3 – Practical components

Not applicable.

Article 4.4 – Elective components

1. Elective courses are listed in Appendix 2.
2. Course components successfully completed elsewhere or that are not included in the list of elective components may be included in the student's programme, subject to prior permission from the Examinations Board.
   a. The courses have to be followed at an accredited university or institute that are according to the Examinations Board of a comparable level.
   b. The course must be relevant to the programme.
3. In terms of content, elective components must not show too much similarity to other components of the student's curriculum. The acceptable degree of similarity will be decided by the Examinations Board.
4. The content and examination method of *Reading Course Mathematics* needs to be approved by the Examinations Board prior to the start of the course.
5. Regarding the free elective components:
   In terms of content, free elective components must not show too much similarity to other components of the student's curriculum. The acceptable degree of similarity will be decided by the Examinations Board. In exceptional cases students may choose Bachelor's-level free elective components as part of their programme. The Examinations Board will determine whether a free elective component at the Bachelor's level will be accepted as part of the programme and the number of credits that will be allocated to the elective component. A free elective component will only be accepted as part of the programme if the Examinations Board has given its prior approval.

Article 4.5 – Sequence and admission requirements

1. Participation in a course may be restricted for students that have not completed certain other components. Information about admission requirements can be found in the Course Catalogue.
2. The Master Project in the regular programme can only be commenced if the compulsory course components and the elective components in the discipline are completed.

Article 4.6 – Participation practical training and tutorials

Not applicable.

Article 4.7 – Exemption

A maximum of 60 EC can be accumulated in the programme through exemptions granted by the Examinations Board.

Article 4.8 – Degree

A student who passes the final examination of a programme is awarded a Master of Science degree. The name of the degree awarded is stated on the diploma.

Article 4.9 – Joint National Master's Programme

Students taking courses as part of Mastermath may also be subject to rules and regulations which have been agreed on nationally. These regulations can be found on: www.mastermath.nl -> 'Courses and Exams'.

Article 4.10 – Double Master's Degree Mathematics and Physics and Astronomy / track Theoretical Physics

1. The candidate must be admitted to both Master programmes.
2. The total study load of the programme of the candidate should amount to at least 180 EC, comprising
    - 40 EC Compulsory components
    - 72 EC Master Project Mathematics and Theoretical Physics
    - 12 EC Constrained choice physics courses
    - 44 EC Constrained choice mathematics courses
    - 12 EC Free elective courses
3. The candidate has conducted an integrated research project Master Project Mathematics and Theoretical Physics (72 EC), replacing Master Project Mathematics (36EC) and Research Project Physics and Astronomy (60EC). This must be supervised by staff members from the two study programmes; both staff members must assess the work as a pass, according to the standards for a research project in their respective master degrees.
4. The integrated research project of article 4.10, point 3 can be replaced by two separate projects: Master Project Mathematics (36 EC), and Research Project Physics and Astronomy (60EC). In this case the total load of the programme must be at least 192 EC.
5. The compulsory components are

- Differential Geometry (8EC, replaces Mathematical Methods from MSc Physics&Astronomy)

- Lie Groups and Lie Algebras (8EC, replaces Group Theory from MSc Physics&Astronomy)

- Quantum Field Theory (6EC)

- Statistical Physics & Condensed Matter Theory 1 (6EC)

- A joint course in Mathematics and Theoretical Physics (6EC). In 2017/18 the course will be Topology in Physics, 6EC

- A joint seminar in Mathematics and Theoretical Physics (6EC). This will be offered for the first time in 2018/19

6. The constrained choice physics courses consist of 12 EC of physics courses from the MSc Physics & Astronomy, including at least 6 EC from the track Theoretical Physics. The courses Mathematical Methods and Group Theory cannot be taken as as part of these 12 EC. The Teaching and Examination Regulations of the MSc Physics & Astronomy contains the list of courses of the MSc Physics & Astronomy, and the sublist of courses from the track Theoretical Physics.
7. The constrained choice courses from MSc Mathematics consists of 44 EC of mathematics courses from the MSc Mathematics, including at least 4 courses from the specializations Algebra & Geometry and Mathematical Physics. At least one of the courses Algebraic Topology, Algebraic Geometry 1 and Riemann Surfaces have to be taken. The Teaching and Examination Regulations of the MSc Mathematics contains the list of courses of the MSc Mathematics, and the sublist of courses from the specializations Algebra & Geometry and Mathematical Physics.

Article 4.11 – Double Master's programme (Mathematics and other two-year programme)

In order to be awarded two Master's degrees, the following requirements must be met:

1. The total programme of the candidate should amount to at least 180 EC credits.
2. The two master programmes may not show too much similarity.
3. The candidate's work for the programme (lectures, research work, etc.), must be of such a standard that all the exit qualifications of each of the two programmes have been met.
4. The candidate must have conducted separate research work for both Master's degrees. This may consist of two separate research projects with supervisors from the respective study programmes. In the case of an integrated research project, this must be supervised by two staff members appointed from the two study programmes. Both staff members must assess the work as a pass, according to the standards for a research project in the respective master degrees. The total number of credits given for an integrated research project is 3/4 of the sum of the credits given for two independent research projects.
5. In addition to 1-4, the other study programme may impose further requirements.
6. The Examinations Boards of both study programmes must approve the student's double Master's programme before the student commences on the double Master's programme.

Article 4.12 – Double Master's Degree Econometrics and Mathematics

In order to be awarded the two different Master's degrees, the following requirements must be met.

1. The total study load of the programme of the candidate should amount to at least 150 EC.
2. The candidate's work for the Master's programme (lectures, research work etc.) is of such a standard that all exit qualifications of each of the two programmes have been met.
3. The candidate has conducted an integrated research project Master Project Econometrics and Mathematics (36 EC), replacing Master Project Mathematics. This must be supervised by staff members from the two study programmes; both staff members must assess the work as a pass, according to the standards for a research project in their respective master degrees.
4. Before starting the second year of their Master's programme, candidates must apply to the Examinations Board of the second study programme for admission to this Master's programme; they also have to inform the Examinations Board of their first study programme that they intend to obtain a double Master's degree.

Chapter 5. Transitional and final provisions

Article 5.1 – Amendments

1. Any amendment to the Teaching and Examination Regulations will be adopted by the dean after taking advice, and if necessary approval by the relevant Board of Studies. A copy of the advice will be sent to the authorised representative advisory body.
2. An amendment to the Teaching and Examination Regulations requires the approval of the authorised representative advisory body as stated in the WHW.
3. An amendment to the Teaching and Examination Regulations is only permitted to concern an academic year already in progress if this does not demonstrably damage the interests of students.

Article 5.2 – Cancelled programme components

Not applicable.

Article 5.3 - Publication

1. The dean shall ensure a fitting publication of part A and B of these Regulations and the rules and guideline referred to in the Act.
2. These regulations can be accessed at the website of the Faculty of Science and the UvA Course Catalogue.

Article 5.4 – Effective date

These Regulations enter into force with effect from 1 September, 2017.

Thus drawn up by the Dean of the Faculty of Science on 30 August 2017.

Appendix 1. Final attainment levels of the major Science in Society (SS), the major Science Communication (SC) and Major Teaching, and learning objectives minor TESLA

A. Final attainment levels of the major Science in Society (SS)

The final attainment levels of the major with regard to the Dublin descriptors are given below.

Dublin descriptor 1: Knowledge and understanding
The graduate has theoretical and practical knowledge of management, policy analysis and entrepreneurship
The graduate:

a. has insight into the various relevant disciplines in the social and behavioural sciences. More specifically, the student acquires insight into:
   - important concepts and theories in the field of policy science, management studies, and entrepreneurship;
   - the relation of these gamma sciences to the beta sciences;
b. has insight into concepts and the latest theories, research methodologies, analytical models and important research questions related to interdisciplinary research for addressing societal problems;
c. has knowledge of, and insight into, relevant concepts and theories for effective communication and collaboration;

Dublin descriptor 2: Applying knowledge and understanding
The graduate is experienced in carrying out interdisciplinary research, in applying techniques specific to the subject area and in applying scientific knowledge to societal problems.
The graduate:

a. has the ability to integrate knowledge from the beta and gamma sciences, as well as from science and practice;
b. can apply scientific knowledge to formulate solutions to societal problems and assess them for appropriateness and societal relevance;
c. adopts an appropriate attitude towards the correct and unbiased use and presentation of data.

Dublin descriptor 3: Making judgements
The graduate is able to independently and critically judge information. The graduate is able to:

a. independently acquire information in relevant scientific areas through a literature review and by conducting empirical research, as well as evaluate such information critically;
b. select and order information, distinguish essentials from trivialities, and recognize connections;
c. formulate personal learning objectives and critically evaluate own performance, both introspectively and in discussion with others.

Dublin descriptor 4: Communication
The graduate is able to transfer knowledge and skills related to his/her subject area to other people and to adequately reply to questions and problems posed within society.
The graduate:

a. has acquired skills to report orally and in writing on research results in English;

b. has the ability to communicate research conclusions, and the knowledge and rationale underpinning them, to specialist audiences and non-specialist audiences clearly and unambiguously;
c. can collaborate with researchers from various scientific disciplines;
d. can make essential contributions to scientific discussions about plans, results and consequences of research.

Dublin descriptor 5: Learning skills
The graduate has developed learning skills that enable him/her to continue with self-education and development within the subject area.
The graduate:
a. has acquired skills to develop a research plan, giving details of the problem statement, objectives, research questions, research approach, research methods, and planning;
b. is familiar with the general scientific journals, such as Nature and Science, and with journals in the specialisation, such as Research Policy, Health Policy, Science, Technology & Human Values, Social Science & Medicine, and International Journal on Technology Management;
c. has the learning skills to allow him/her to continue to study in a manner that may be largely self-directed or autonomous (life-long learning).

B. Final attainment levels of the major Science Communication (SC)
The MSc graduate possesses an academic attitude, skills and competences to operate at the interface of science and society aiming to contribute to a fruitful science-society dialogue. This means that Master's graduates have the following focus:
- Understanding the dynamic relationship between science and society
- Translating information from the natural sciences to society and vice versa
- Shaping the dialogue between science and society

Knowledge
- Knowledge of and insight into the relevant concepts and theories in the field of science communication, sociology, communication science, philosophy and science & technology studies in relation to the natural sciences
- Familiarity with scientific journals in the field of science communication and science & technology studies, as well as familiarity with a variety of popular-scientific media
- Insight into the nature and course of interpersonal and group communication processes relevant to the formal and informal dialogue between science and society
- Insight into relevant concepts and theories for effective communication and collaboration in relation to diverse science-society interactions
- Insight into the popularization of the natural sciences in various media
- Insight into the roles and responsibilities of museums in science communication

Skills
- Independently acquire, analyze and evaluate relevant information in a variety of scientific disciplines, by conducting literature study and empirical research
- Communicate and collaborate effectively with diverse professionals of scientific and non-scientific disciplines as well as lay citizens
- Design and facilitate interactive processes in relation to the science-society dialogue
- Translate information from various natural science disciplines into more generally accessible language and formats

- Produce popular-scientific media output concerning developments in the natural sciences, aimed at a variety of publics
- Contribute to the design of museum exhibitions from the perspective of scientific content management and science communication theory
- Make an intrinsic contribution to the societal discussion of developments in science and technology

C. Final attainment levels of the major Teaching

Aan het eind van de opleiding moet de student beschikken over de kwaliteiten ofwel competenties op het gebied van geïntegreerde kennis, inzicht en vaardigheden behorend bij het beroep van leraar in het eerstegraads gebied van het voortgezet onderwijs. De competenties hebben betrekking op de taakgebieden waarvoor wordt opgeleid: onderwijzen, begeleiden, organiseren, ontwikkelen en onderzoeken, en professionaliseren. De competenties zijn de volgende.

• *Interpersoonlijk competent*

Je bent interpersoonlijk competent als je in het contact met leerlingen (en ook met anderen) kunt leiden, begeleiden, bemiddelen, stimuleren en confronteren. Daarmee bereik je een klimaat met open communicatie en een sfeer van samenwerking en wederzijds vertrouwen.

• *Pedagogisch competent*

Je bent pedagogisch competent als je benaderingen kunt ontwerpen, uitvoeren en evalueren om het welbevinden van leerlingen te bevorderen, om ontwikkelings- en gedragsproblemen te signaleren en om groepen en individuen te begeleiden. Daarmee bereik je een veilige leeromgeving waarin leerlingen zich kunnen ontwikkelen tot zelfstandige en verantwoordelijke personen.

• *Vakinhoudelijk en didactisch competent*

Je bent vakinhoudelijk en vakdidactisch competent als je je eigen vak gedegen beheerst, op basis daarvan aantrekkelijke, effectieve en efficiënte leeractiviteiten kunt ontwerpen, uitvoeren, begeleiden en evalueren. Daarmee bereik je een krachtige leeromgeving voor leerlingen.

• *Organisatorisch competent*

Je bent organisatorisch competent als je concrete en functionele procedures en afspraken kunt hanteren en als je de leeromgeving en het leren van leerlingen kunt organiseren en faciliteren en de planning kunt bewaken en bijstellen. Daarmee bereik je een overzichtelijke, ordelijke en taakgerichte leeromgeving.

• *Competent in het samenwerken met collega's*

Je bent competent in het samenwerken met collega's als je informatie deelt, actief bijdraagt aan overleg en samenwerkingsverbanden en deelneemt aan collegiale consultatie. Daarmee bevorder je een collegiale en harmonieuze werksfeer.

• *Competent in het samenwerken met de omgeving*

Je bent competent in het samenwerken met de omgeving als je doelmatige contacten onderhoudt met ouders (verzorgers), maar ook met andere mensen en instanties die te maken hebben met de zorg voor en de opleiding van leerlingen. Daarmee bereik je dat de ontwikkeling van leerlingen op een realistische en constructieve manier wordt ondersteund en dat eventuele problemen tijdig worden onderkend en opgelost.

• *Competent in reflectie en onderzoek ten dienste van ontwikkeling*

Je bent competent in reflectie als je je handelen planmatig kunt bijstellen op grond van ervaringen in beroepssituaties. Daarmee bereik je professioneel leren en ontwikkeling van jezelf. Je bent competent in onderzoek als je de beroepspraktijk in het algemeen en je eigen beroepspraktijk in het bijzonder kunt analyseren met distantie en met onderzoeksmatige deskundigheid. Daarmee bereik je ontwikkeling van je school, van de didactiek van je vak en/of van jezelf.

D. Learning Objectives Tesla

Main Objective

To offer ambitious science students with a demonstrated excellent Academic and non-Academic track record the opportunity to engage in a final challenge before finishing their research master programme.

On completing the Tesla Programme the graduate has acquired the qualities to bridge Science, Society and Business within complex research and project challenges related to the own scientific background. The graduate is fit to start a career in demanding environments which require abilities to utilize the disciplinary science background (as described in OER B) in work environments within or outside of science.

These qualities will be developed while 1) working on an interdisciplinary project related to the scientific background of the graduate and 2) undergoing intensive training on a range of skills.

General Objectives

The graduate has:

1. The analyzing, problem-solving and synthesizing abilities in order to be able to function at the required academic level
2. The abilities to utilize his or her specific scientific background (as specified in the OER B of the Master Programme in which the student is enrolled) in settings on the interface of science, business and society
3. A series of practical professional, academic and personal skills which result in the ability to
    a. independently set up, manage and execute an interdisciplinary projects at the interface of science, business and society. Thereby utilizing scientific knowledge in contributing to a real demand of a knowledge intensive organization
    b. get acquainted with a field of study in a short period of time by self-study, to form one's own opinion and to communicate critically and effectively with different audiences on the topic
    c. deal with complex challenges and gather and structure information on different levels to enable professional action in different fields and especially the ability to utilize his/her own scientific background in a non-Academic environment
    d. Communicate effectively with different stakeholders (e.g. business professionals, policymakers) while using appropriate means (e.g. business plans, policy advice).
    e. operate effectively in interdisciplinary teams.
4. An attitude that enables the student to critically reflect on his/her own actions

In doing so the graduate should have acquired the following qualities in the fields of 'Professional Knowledge & Insight' and 'Professional Skills':

Professional Knowledge and Insight

Students should develop professional knowledge and insight regarding bringing "science to value in practice", especially in relation to their scientific background. More specifically, students should:

a. Obtain understanding of different business practices, discourses and settings with regard to bringing scientific knowledge to value.
b. Develop knowledge on scientific developments in relevant disciplines related to dealing with the societal challenges of 21th century.
c. Obtain understanding of different non-profit practices and settings with regard to bringing scientific knowledge to value
d. Obtain understanding of different governmental practices and settings with regard to bringing scientific knowledge to value.
e. Increase knowledge and insight of possible career paths and possible roles in bringing scientific knowledge to value.

Professional Skills

Students should develop professional business skills to operate effectively in organizations and groups. More specifically, students should:

f. Develop professional cooperation skills.
    i. Develop presentation skills: the abilities necessary to communicate complex information and deliver professional presentations in different environments.
    ii. Develop feedback skills
    iii. Develop meeting skills: the abilities necessary to host and guide meetings in which complex information, different opinions and positions need to be structured to effectively facilitate collection work.
    iv. Develop teamwork and leadership skills.
    v. Develop interview techniques: abilities necessary to successfully obtain information by means of an interview in different settings.
    vi. Develop reasoning and related skills to structure information: develop the abilities to test arguments and bring propositions towards implementation by convincing others.
    vii. Develop communication and influencing skills.

g. Develop project management skills.
    i. Be able to effectively manage projects on the interface of Science and Practice, including becoming familiar with:
        1. Taking Initiative
        2. Managing the workflow
            a. Preparing a project planning
            b. Use of KPIs in Planning
            c. Prioritizing & adjustment (time management, etc.)
        3. Practical Tools
            a. Effective use of communication technology
            b. Budget management
        4. Team Management
            a. Engaging your interdisciplinary team
            b. Divide and take Responsibility

c. Solving problems

ii. Get acquainted with consultancy analytics and tools to structure complex challenges & information.
    1. Utilizing consultancy models to structure complex challenges and transform them into workable solutions.
    2. Develop visual thinking skills: the qualities to use visual tools to structure meetings, complex information and group processes.

E. minor teaching na een bachelor met een educatieve minor

De student volgt het tweede semester van de master leraar VHO die de ILO aanbiedt. De eindtermen komen overeen met die van de major teaching, zie hierboven.

F. minor teaching na een bachelor zonder educatieve minor

De student volgt het eerste semester van de master leraar VHO die de ILO aanbiedt.
De opleiding leidt niet tot een bevoegdheid.
De eindtermen komen grotendeels overeen met die van de educatieve minor die de ILO aanbiedt.

De student is op basis van voldoende theoretisch inzicht, een professionele houding en voldoende vaardigheid in staat om:

1. een goede samenwerking met en tussen leerlingen tot stand te brengen;
2. voor groepen en voor individuele leerlingen een veilige leeromgeving te creëren;
3. voor groepen en voor individuele leerlingen een krachtige leeromgeving in te richten waarin leerlingen zich op een goede manier leerinhouden van het vakgebied eigen maken;
4. in groepen en in andere contacten met leerlingen een overzichtelijk, ordelijk en taakgericht leer- en werkklimaat tot stand te brengen;
5. relevante informatie uit te wisselen met collega's in de school en uitkomsten daarvan te benutten;
6. relevante informatie uit te wisselen met verzorgers van leerlingen buiten school en daarin te zorgen voor afstemming;
7. eigen opvattingen over het leraarschap en de eigen bekwaamheden als leraar, te expliciteren, kritisch te onderzoeken en verder te ontwikkelen op basis van theoretische inzichten en empirische gegevens.

Appendix 2. Description of the content and study load of the components

Format: L: lectures and/or tutorials; PR: presentation.; Lit: literature study; PROJ: Project
Assessment: E: written and/or oral exam; P: presentation; R: report

Course	code UvA	code VU	EC	period	Format	Ass.
Constrained Electives						
Advanced Algebraic Geometry: Algebraic Surfaces	5334AAGA8Y		8	1, 2	L	E
Advanced Combinatorics	53348ADC8Y		8	1, 2	L	E
Advanced Hamiltonian Dynamics	5334ADHD8Y		8	1, 2	L	E
Advanced Linear Programming	53348ALP6Y		6	4, 5	L	E
Algebraic Geometry 1	53341ALG8Y		8	1, 2	L	E
Algebraic Geometry 2	53342ALG8Y		8	4, 5	L	E
Algebraic Methods in Combinatorics	5334AMIC8Y		8	4, 5	L	E
Algebraic Number Theory	53348ANT8Y		8	1, 2	L	E
Algebraic Topology	53348ALT8Y		8	1, 2	L	E
Algebraic Topology 2	53342ALT8Y		8	4, 5	L	E
Algorithms Beyond the Worst Case	5334ABTW8Y		8	4, 5	L	E
Algorithmic Geometry of Numbers	5334ALGN8Y		8	4, 5	L	E
Applied Finite Elements	53348AFE6Y		6	4, 5	L	E
Applied Statistics	5334SPST6Y		6	4, 5	L	E
Applied Stochastic Modelling	53348APS6Y	VU	6	1, 2	L	E
Asymptotic Statistics	5374ASST8Y		8	1, 2	L	E
Category Theory and Topos Theory	5334CTTT8Y		8	4, 5	L	E
Coding and Cryptography	53348CCR6Y	VU	6	4	L	E
Coding Theory	53348CTH8Y		8	4, 5	L	E
Commutative Algebra	53348COA8Y		8	1, 2	L	E
Complexity Theory	5334COTH8Y		8	1, 2	L	E
Computational Complexity	5314COCO6Y		6	4	L	E
Continuous Optimization	53348COP6Y		6	1, 2	L	E
Cryptology	5334CRYP5Y		5	1, 2	L	E
Descriptive Set Theory	5334DEST8Y		8	4, 5	L	E
Differential Geometry	53348DIG8Y		8	1, 2	L	E
Discrete Choice Analysis: Theory and Application	5334DCAT8Y	VU	8	4, 5	L	E
Discrete Optimization	53348DOP6Y		6	1, 2	L	E
Dynamical Systems	53348DYS8Y		8	1, 2	L	E
Dynamics of Networks	5334DYNE6Y		6	4, 5	L	E
Elliptic Curves	53348ELC8Y		8	4, 5	L	E
Forensic Probability and Statistics	5334FOPS8Y		8	1, 2	L	E
Foundations of General Relativity	5334FOGR8Y		8	4, 5	L	E
Functional Analysis	53348FUA8Y		8	1, 2	L	E
Heuristic Methods in Operations Research	53348HMO6Y		6	1, 2	L	E
Interest Rate Models	5374INRM6Y		6	1, 2	L	E
Introduction to Numerical Bifucation Analysis of ODE's and Maps	53348ITN8Y		8	4, 5	L	E

Inverse Problems in Imaging	5334IPII8Y		8	4, 5	L	E
Lie Groups and Lie Algebras	5334LGLA8Y		8	4, 5	L	E
Machine Learning Theory	5334MALT8Y		8	1, 2	L	E
Mathematical Biology	53348MAB8Y		8	1, 2	L	E
Measure Theoretic Probability	5374METP8Y		8	1, 2	L	E
Modular Forms	5334MOFO8Y		8	4, 5	L	E
Nonlinear Waves	5334NOWA8Y		8	4, 5	L	E
Numerical Linear Algebra	53348NLA8Y		8	1, 2	L	E
Operator Algebras	53348OPA8Y		8	4, 5	L	E
Optimisation of Business Processes	53348OPB6Y	VU	6	4, 5	L	E
Parallel Algorithms	53348PAA8Y		8	1, 2	L	E
Partial Differential Equations	53348PAD8Y		8	1, 2	L	E
Percolation: from Introduction to Frontiers of Current Research	5334PITF8Y		8	4, 5	L	E
Poisson Geometry	5334POGE8Y		8	1, 2	L	E
Portfolio Theory	5374POTS6Y		6	1, 2	L	E
Probabilistic and Extremal Combinatorics	53348PRE8Y		8	1, 2	L	E
Quantum Computing	5334QUCO8Y		8	4, 5	L	E
Quantum Groups and Integrable Systems	5334QGIS6Y		6	4, 5	L	E
Queueing Theory	53748QUT6Y		6	4, 5	L	E
Queues and Levy Fluctuation Theory	5334QLFT6Y		6	4, 5	L	E
Quivers	5334QUIV6Y		6	1, 2	L	E
Reading course Mathematics	5334RECM6Y		6	1-6	PR, Lit	E, P
Riemann Surfaces	53348RIS8Y		8	4, 5	L	E
Scheduling	53748SCH6Y		6	4, 5	L	E
Selected Areas in Cryptology	5334SAIC8Y		8	4, 5	L	E
Semidefinite Optimization	53348SEO8Y		8	4, 5	L	E
Set Theory	53348SET8Y		8	1, 2	L	E
Simulation Methods in Statistics	5374SIMS6Y		6	1, 2	L	E
Statistical Models	53348STM6Y	VU	6	1, 2	L	E
Statistics for High-Dimensional Data	53348SFH6Y		6	1, 2	L	E
Statistical Theory for High- and Infinite-Dimensional Models	5334STFH8Y		8	4, 5	L	E
Stochastic Differential Equations	53348STD6Y		6	4, 5	L	E
Stochastic Integration	5374STIN8Y		8	4, 5	L	E
Stochastic Optimization	53748SOP6Y	VU	6	1, 2	L	E
Stochastic Processes	53748STP8Y		8	4, 5	L	E
Stochastic Processes for Finance	53748SPF6Y	VU	6	1, 2	L	E
Stochastic Simulation	5334STSI6Y		6	1, 2	L	E
Systems and Control	53348SYC6Y		6	1, 2	L	E
TFT and Moduli Spaces	5324TFMS6Y		6	1, 2	L	E
Time Series	53748TIS8Y		8	4, 5	L	E
Topics in Complex Analysis	5334TICA6Y		6	1, 2	L	E
Topology in Physics	5354TOIP6Y		6	4, 5	L	E

Master Seminar (6EC required)						
Master Seminar in Algebra and	5334MSIA6Y		6	1, 2, 4, 5	L, PR	P

Geometry						
Master Seminar in Analysis and Dynamical Systems	5334MSIA6Y	VU	6	1, 2, 4, 5	L, PR	P
Master Seminar in Stochastics	5334MSIS6Y	VU	6	1, 2, 4, 5	L, PR	P

Master Project (36EC required)						
Master Project Mathematics			36	1-6	PROJ	
Master Project Econometrics and Mathematics (double master programme)			36	1-6	PROJ	