Teaching and Examination Regulations

MASTER's Degree Programme

Bioinformatics

B. Programme-specific section

Academic year 2016-2017

Section B: Programme-specific section

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1. General provisions

Article 1.1 Definitions

In addition to the definitions as laid down in article 1 of TER part A, the following abbreviations are also used in TER part B:

Examination	**Abbr.**
Exam	E
Report, essay	R
Presentation	Pres
Practical	Prac
Assignment	A
Field Work	FW

Teaching method	**Abbr.**
Lecture	HC
Tutorial	WC
Study group	WG
Computer Lab	CPR
Practical	PR
Field Work	VW
Excursion	EXC
Training	TR

Article 1.2 Degree programme information

1. The Master's programme in Bioinformatics (CROHO number 60106) is offered on a full-time basis in collaboration with the University of Amsterdam (UvA, Amsterdam) and the language of instruction is English.
2. The programme consists of 120 credits.
3. Within the programme the following track is offered:
   - Systems Biology and Bioinformatics
4. An educational unit comprises 6 credits or a multiple thereof

Article 1.3 Intake dates

The programme is offered starting in the first semester of the academic year only (1 September). The intake date(s) mentioned in this paragraph ensure(s) that a programme can be completed within the nominal study duration set for the programme.

2. Programme objectives and exit qualifications

Article 2.1 Programme objective

The programme aims at:

- teaching students to conduct empirical research to develop their practical skills, knowledge and insights into bioinformatics and systems biology;
- enabling students to perform research in various application fields of bioinformatics and systems biology;
- teaching key techniques and formalisms, while providing sufficient options for differentiation;
- teaching student the technical skills of programming and modelling, all applied to problems in molecular biology and genomics;

- providing a student-oriented education that is of high, internationally recognised quality;
- providing a feasible study programme to a heterogeneously composed student population in an inspiring academic learning environment of two universities.

Article 2.2 Exit qualifications

1. The graduate of the Master's programme Bioinformatics [between brackets the most associated Dublin descriptor(s)]:
   - has both a solid academic basic as well as specialist knowledge and understanding in the field of bioinformatics and systems biology and in one or more sub-areas of bioinformatics and systems biology, and related fields such as biophysics, biochemistry, mathematic modelling and cell biology [Knowledge and understanding];
   - has acquired profound knowledge, insight and practical experience in at least one specialist area of bioinformatics or systems biology [Knowledge and understanding, Applying knowledge and understanding];
   - has knowledge and understanding of the iterative process i.e. the relation between model, experiment and reality, of systems biology [Knowledge and understanding, Making judgements];
   - has the ability to access and use international professional literature and master current scientific research developments and has knowledge of current scientific developments within relevant subdomains of bioinformatics and systems biology [Knowledge and understanding];
   - has the ability to get acquainted with a field of study and acquire specialist knowledge, understanding and skills in a short period of time [Making judgements];
   - has insight of the applications of bioinformatics and systems biology in general and specific specialisations in particular and is able to apply this knowledge in new and continuously changing practical situations, also in broader, multidisciplinary contexts [Applying knowledge and understanding];
   - is capable of writing research or project proposals on the basis of realistic problem descriptions or to write a critical essay based on literature within a specialised field of study and one's opinion [Knowledge and understanding, Applying knowledge and understanding, Making judgements];
   - has the ability to independently set up and implement experiments contributing to a line of research [Applying of knowledge and understanding, Learning skills];
   - has the skills to analyse and interpret biological patterns and processes in both a qualitative and quantitative sense and make inferences based on these scientific results [Applying knowledge and understanding];
   - has the skills to present research projects and results both orally and written in English, at various scales and levels of abstraction, and communicate these to specialist and non-specialist audiences [Communication];
   - has an attitude that enables critical reflection and discussion [Making judgements, Learning skills];
   - has the ability to successfully fulfill a position in society requiring an academic qualification as an independently operating professional that has a good knowledge base and attitude towards a biological approach to relevant societal issues [Learning skills];
   - has the ability to continue his/her career either as a researcher able to pursue a PhD degree at the best universities, as a scientist in research institutes worldwide, or as a research-skilled professional in organisations of government, civil society or business and industry [Applying knowledge and understanding, Making judgements].
2. In addition to paragraphs 1, the graduate who has chosen to do the minor Tesla as mentioned in article 4.4, obtains the exit qualifications as listed in the appendix.

3. Further admission requirements

Article 3.1 Admission requirements

1. A student, who has obtained a Bachelor's degree in Biology, Biomedical Sciences, (Bio/Medicinal)Chemistry, Computer Sciences, Engineering, Health Sciences, (Bio)Informatics, Mathematics, Medical (Natural) Sciences, Medicine, Pharmaceutical Sciences or Physics from the University of Amsterdam (UvA) or from the Vrije Universtiteit VU; Amsterdam) may enter the programme.
2. Candidates possessing an equivalent (as compared to the programmes mentioned in paragraph 1) BSc degree from a Dutch University may enter the programme provided that the

student has obtained sufficient knowledge in the fields of Biology and Mathematics. An intake may be part of the admission procedure.

3. Without prejudice to the provisions of paragraphs 1 and 2 the Examinations Board may, after asking advice of the programme director, decide whether a candidate whose academic Bachelor does not meet aforementioned entry requirements is eligible for admission. An interview may be part of the intake procedure.
4. When the programme commences, the candidate must have fully completed the Bachelor's programme allowing admission to this Master's programme.

Article 3.2 Pre-Master's programme

Not applicable

Article 3.3 Limited programme capacity

Not applicable

Article 3.4 Final deadline for registration

A candidate must submit a request to be admitted to the programme through Studielink before 1 May in the case of Dutch students, before 1 April in the case of EU students and before 1 February in the case of non-EU students. Under exceptional circumstances, the Examinations Board may consider a request submitted after this closing date.

Article 3.5 English language requirement for English-language Master's programmes

1. The proficiency requirement in English as the language of instruction can be met by the successful completion of one of the following examinations or an equivalent:
   - IELTS: 6.5
   - TOEFL paper based test: 580
   - TOEFL internet based test: 92-93
   - Cambridge Advanced English: A, B or C.
2. Exemption is granted from the examination in English referred to in the first paragraph to students who, within two years of the start of the programme:
   - met the requirements of the VU test in English language proficiency TOEFL ITP, with at least the scores specified in paragraph 1, or
   - had previous education in secondary or tertiary education in an English-speaking country as listed on the VU website, or
   - have an English-language 'international baccalaureate' diploma

Article 3.6 Free curriculum

1. Subject to certain conditions, the student has the option of compiling a curriculum of his/her own choice which deviates from the curricula prescribed by the programme.
2. The concrete details of such a curriculum must be approved beforehand by the most appropriate Examinations Board.
3. The free curriculum is put together by the student from the units of study offered by Vrije Universiteit Amsterdam or another institution of higher education and must at least have the size, breadth and depth of a regular Master's programme.
4. The following conditions must at least have been met in order to be eligible for the Master's degree:
   a. At least 60 EC must be obtained from the regular programme,
   b. The level of the free curriculum programme must match the objective and exit qualifications that apply for the programme for which the student is enrolled.

4. Curriculum structure

Article 4.1 Composition of programme

1. The curriculum consists of the following components:
   a. General compulsory components amounting to 84, including research projects
   b. Specialisation-specific compulsory components amounting to 18 EC
   c. Practical components
   d. Elective components amounting to a maximum of 18 EC

Article 4.2 Compulsory units of study

1. In the UvA and VU Course Catalogue the content, format and examination requirements of each compulsory component of the study programme are described, indicating the preconditions that are required in order to be able to follow the course successfully.
2. In the specialisation Systems Biology a so-called list of courses is part of the study programme. The student has to choose from this constrained list of courses. In the UvA and VU Course Catalogue the content, format and examination requirements of these components of the study programme are described.
3. For each specialisation the compulsory components are given below:

Compulsory courses (84 EC required) – both specialisations

Course code	Course component	EC	Period	Teaching method	Examination format	Level
XM_405027	First internship (Major)	42	Ac. Year		R, pres	400
XM_405032	Second internship (Minor)	18	Ac. Year		R, pres	400
X_405052 (VU)	Fundamentals of Bioinformatics	6	1	CPR, HC	E, A	400
X_428565 (VU)	Introduction to Systems Biology	6	1	WC, WG, HC	E, A	400
XMU_437001 (UvA)	Biosystems Data Analysis	6	3			400

Compulsory optional courses (6 EC required; max 6 EC allowed)

Course code	Course component	EC	Period	Teaching method	Examination format	Level
X_400594 (VU)	Seminar series and writing a research proposal	6	Ac. Year		R, Pres	500
5304TSBB6Y (UvA)	Literature Review	6	Ac. Year		R	500

Compulsory Courses Bioinformatics Major (18 EC required)

Course code	Course component	EC	Period	Teaching method	Examination format	Level
X_405050 (VU)	Algorithms in Sequence Analysis	6	2	WC, HC	E, A, Prac	400
X_405019 (VU)	Structural Bioinformatics	6	4	PR, HC	E, A, Prac	400
X_405092 (VU)	Bioinformatics for Translational Medicine	6	5	PR, HC	E, A, Prac	400

Compulsory courses Systems Biology Major (12 EC required)

Course code	Course component	EC	Period	Teaching method	Examination format	Level
XMU_418157 (UvA)	Systems Biology in Practice	6	2			400
X_418154 (VU)	Basic Models of Biological Networks	6	4	WC, CPR, HC	E, A	400

Compulsory optional courses System Biology Major (6 EC required)

Course code	Course component	EC	Period	Teaching method	Examination format	Level
XMU_418125 (UvA)	Synthetic Biology and Biomedicine	6	4			
X_418156 (VU)	Statistics with R	6	5	HC	A	400
X_418155 (VU)	Advanced Modeling in Systems Biology	6	6	WC, CPR, HC	E, A	500

Article 4.3 Practical exercise

Except for those practical components incorporated in the compulsory units of study above and in relevant electives, the programme has no separate practical exercise.

Article 4.4 Electives

1. Elective courses may be part of the study programme. In the VU/UVA Course Catalogue the content, format and examination requirements of elective courses are described. The student must choose 18 EC of elective courses. The components below may be chosen without asking prior approval of the Examinations Board.

Optional Courses

Course code	Course component	EC	Period	Teaching method	Examination format	Level
X_405050 (VU)	Algorithms in Sequence Analysis	6	2	WC, HC	E, A, Prac	400
X_405019 (VU)	Structural Bioinformatics	6	4	PR, HC	E, A, Prac	400
X_405092 (VU)	Bioinformatics for Translational Medicine	6	5	PR, HC	E, A, Prac	400
XMU_418157 (UvA)	Systems Biology in Practice	6	2			400
X_418154 (VU)	Basic Models of Biological Networks	6	4	WC, CPR, HC	E, A	400
XMU_418125 (UvA)	Synthetic Biology and Biomedicine	6	4			
X_418156 (VU)	Statistics with R	6	5	HC	A	400
X_418155 (VU)	Advanced Modeling in Systems Biology	6	6	WC, CPR, HC	E, A	500
X_432535 (VU)	Signal Transduction in Health and Disease	6	2	HC	E, A, Pres	600
X_400154 (VU)	Machine Learning	6	4	WC, HC		300
X_400108 (VU)	Data Mining Techniques	6	5	HC	A	500

1. The student can choose to participate in the minor Tesla, offered at the UvA.
   a. The Minor Tesla consists of 30 EC. The minor must be combined with a research programme, comprising at least 90 EC of the general compulsory components (courses, research project and literature study) in order to meet the general requirements of the programme. The minor consist of a course component and a project-based component. This project-based component has to be supervised by a Faculty examiner and is subject to prior approval of the Examinations Board. Because it is a multidisciplinary minor an examiner from the research programme has to be appointed as a second assessor. Further information on this minor can be found at http://www.student.uva.nl
   b. Students have to go through a separate intake procedure for admission to the minor Tesla.
   c. Students first have to finish at least 60 EC of the compulsory part of the programme (60 EC) before starting the minor.
   d. It is not permitted to take the obligatory research part of the programme and the minor simultaneously.
   e. The student can participate in the minor Tesla without prior approval of the Examinations Board when following the programme as described below

Specialisation Bioinformatics	Programme with Minor Tesla
Compulsory Courses	36 EC
Algorithms in Sequence Analysis	*6 EC*
Bioinformatics for Translational Medicine	*6 EC*
Biosystems Data Analysis	*6 EC*
Introduction to Systems Biology	*6 EC*
Fundamentals of Bioinformatics	*6 EC*
Structural Bioinformatics	*6 EC*
Elective courses	18 EC
Research Project[1]	30 EC
Literature Review or Seminar Series and Writing a Research Proposal	6 EC
Components Minor Tesla	30 EC
Total Study Load	120 EC

Specialisation Systems Biology	Programme with Minor Tesla
Compulsory Courses	36 EC
Basic Models of Biological Networks	*6 EC*
Biosystems Data Analysis	*6 EC*
Introduction to Systems Biology	*6 EC*
Fundamentals of Bioinformatics	*6 EC*
Systems Biology in Practice	*6 EC*
Advanced Modelling in Systems Biology or Statistics with R	*6 EC*
Elective courses	18 EC
Research Project[1]	30 EC
Literature Review or Seminar Series and Writing a Research Proposal	6 EC
Components Minor Tesla	30 EC
Total Study Load	120 EC

[1]One research programmes of 30 EC each. Participation in iGEM will account for a 24 ECTS credits research project. It is not permitted to participate in both iGEM project and minor Tesla during the Master's programme.

2. If the student wishes to take a different subject than the units of study listed (see paragraph 4.4.1), advance permission must be obtained in writing from the Examinations Board. These units:
   a. have to be followed at an accredited university or institute;
   b. have to be relevant to the master chosen.
3. In terms of content, elective components, as referred to in paragraph 3, must not show too much similarity to the components of the student's standard curriculum. The Examinations Board will decide on the acceptable degree of similarity.
4. An elective component, as referred to in paragraph 3, will only be seen as part of the programme when the Examinations Board has given its prior approval.

Article 4.5 Sequence of examinations

1. Students may participate in examinations (and/or practical exercises) of the units below if they have passed the examination or examinations for the units mentioned hereinafter:
   a. The student has to successfully complete 18 EC of compulsory courses prior to approval and starting of the research project.

In cases where the result of a component has not been determined within the time periods mentioned in Article 4.4 of part A, this component may not be required as prior knowledge for the subsequent component.

Article 4.6 Participation in practical exercise and tutorials

Not applicable

Article 4.7 Maximum exemption

1. A maximum of 60 EC of the curriculum can be accumulated through granted exemptions.
2. At the written request of the student, the Examinations Board may exempt the student from taking one or more examination components, if the student:
   a. Has passed a component of an academic or higher professional education programme that is equivalent in both content and level;
   b. Has demonstrated through his/her work and/or professional experience that he/she has sufficient knowledge and skills with regard to the relevant component.
3. This exemption does not apply to the Research Project 2.
4. Exemptions from examinations (or parts thereof), if granted, will be valid for the same period of examinations.

Article 4.8 Validity period for results

As laid down in article 4.8 of TER part A.

Article 4.9 Degree

Students who have successfully completed their Master's final examination are awarded a Master of Science degree. The degree awarded is stated on the diploma. If it is a joint degree, this will also be stated on the diploma.

Article 4.10 – Determining results of examinations

In addition to Article 4.6 of Part A, in case the examination of a component consists of two or more parts, each part has to be graded with a 5.0 or higher to pass the examination.

5. Transitional and final provisions

Article 5.1 Amendments and periodic review

1. Any amendment to the Teaching and Examination Regulations will be adopted by the faculty board after taking advice from the relevant Board of Studies. A copy of the advice will be sent to the authorized representative advisory body.
2. An amendment to the Teaching and Examination Regulations requires the approval of the authorized representative advisory body if it concerns components not related to the subjects of Section 7.13, paragraph 2 sub a to g and v of the WHW and the requirements for admission to the Master's programme.

3. An amendment to the Teaching and Examination Regulations can only pertain to an academic year that is already in progress if this does not demonstrably damage the interests of students.

Article 5.2 Transitional provisions

Not applicable

Article 5.3 Publication

1. The faculty board will ensure the appropriate publication of these Regulations and any amendments to them.
2. The Teaching and Examination Regulations will be posted on VUnet and deemed to be included in the course catalogue.

Article 5.4 Effective date

These Regulations enter into force with effect from 1 September 2016.

Advice from Board of Studies, 23 June 2016

Advice from Examination Board of the Faculty of Sciences on 5 July 2016

Approved by authorized representative advisory body on 30 June 2016

Adopted by the Board of the Faculty of Earth and Life Sciences / of Sciences on 14 July 2016.

Appendix I

List of articles that must be included in the OER pursuant to the WHW (articles in framed boxes):

Section A

Art. 1.1	7.13, para 1, WHW
Art. 2.1	7.13, para 2 sub w
Art. 3.2	7.13, para 2 sub e
Art. 4.2	7.13, para 2 sub h and l
Art. 4.3	7.13, para 2 sub n
Art. 4.4	7.13, para 2 sub o
Art. 4.5	7.13, para 2 sub j, h
Art. 4.7	7.13, para 2 sub r
Art. 4.8	7.13, para 2 sub k
Art. 4.9	7.13, para 2 sub p
Art. 4.10	7.13, para 2 sub q
Art. 4.11	7.13, para 2 sub a
Art. 5.1	7.13, para 2 sub u
Art. 5.2	7.13, para 2 sub m

Section B

Art. 1.2	7.13, para 2 sub i
Art. 2.1	7.13, para 1 sub b, c
Art. 2.2	7.13, para 2 sub c
Art. 3.1	7.25, para 4
Art. 4.1	7.13, para 2 sub a
Art. 4.2	7.13, para 2 sub e, h, j, l
Art. 4.3	7.13, para 2 sub t
Art. 4.4	7.13, para 2 sub e, h, j, l
Art. 4.5	7.13, para 2 sub s
Art. 4.6	7.13, para 2 sub d
Art. 4.8	7.13, para 2 sub k

- Appendix-

Learning objectives minor 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's 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.

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:
1. Obtain understanding of different business practices, discourses and settings with regard to bringing scientific knowledge to value;
2. Develop knowledge on scientific developments in relevant disciplines related to dealing with the societal challenges of 21th century;
3. Obtain understanding of different non-profit practices and settings with regard to bringing scientific knowledge to value;
4. Obtain understanding of different governmental practices and settings with regard to bringing scientific knowledge to value;
5. 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:
1. Develop professional cooperation skills.
    a. Develop presentation skills: the abilities necessary to communicate complex information and deliver professional presentations in different environments;
    b. Develop feedback skills;

c. 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;
d. Develop teamwork and leadership skills;
e. Develop interview techniques: abilities necessary to successfully obtain information by means of an interview in different settings;
f. Develop reasoning and related skills to structure information: develop the abilities to test arguments and bring propositions towards implementation by convincing others;
g. Develop communication and influencing skills.

2. Develop project management skills.
   a. Be able to effectively manage projects on the interface of Science and Practice, including becoming familiar with:
      - Taking Initiative
      - Managing the workflow
      - Preparing a project planning
      - Use of KPIs in Planning
      - 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
   d. Get acquainted with consultancy analytics and tools to structure complex challenges & information.
      - Utilizing consultancy models to structure complex challenges and transform them into workable solutions;
      - Develop visual thinking skills: the qualities to use visual tools to structure meetings, complex information and group processes.