UNIVERSITY OF AMSTERDAM

FACULTY OF SCIENCE
TEACHING AND EXAMINATION REGULATIONS
PART B

Academic year 2019-2020

MASTER'S PROGRAMME MATHEMATICAL PHYSICS

Contents

Chapter 1. General Provisions

Article B-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 always resulting in a written report

Article B-1.2 – General information master's programme

1. The Master's programme Mathematical Physics, CROHO 60232, 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.
2. The programme has a workload of 120 EC.

Article B-1.3 – Enrolment

The programme starts at the beginning of the first semester (September) of the study year.

Chapter 2. Aim of the programme and exit qualifications

Article B-2.1 – Aim of the programme

The objectives of the Master's programme is to provide students with knowledge, abilities and insight in the field of mathematical physics to enable them to work as a mathematical physics professional at an international level, or to become qualified to pursue advanced training as scientific researcher in a Dutch or in a foreign university.

Article B-2.2 – Exit qualifications

The student graduating from the programme:

a) has a thorough theoretical and practical knowledge of modern mathematics and theoretical physics;
b) has a good and broad overview of the problems, techniques and working methods of modern mathematical physics;
c) is able to apply one's knowledge of mathematical physics in a broader (multidisciplinary) context;
d) is capable of independent orientation and application of theoretical-physical as well as mathematical (international) professional literature;
e) is able to formulate a research plan, based on a realistic problem within the discipline of mathematical physics;
f) is able to carry out research independently into either a mathematical problem with a significant physical character, or to carry out research into a physical problem with a distinctive mathematical content;
g) is able to analyse and formulate research results and to draw conclusions from them;
h) is able to incorporate the obtained results and conclusions within the frame work of the results of other scientists;
i) is able to write a scientific report;
j) is able to exchange ideas with fellow researchers;
k) is able to communicate with mathematicians and theoretical physicists in speech and in writing and by giving presentations that are comprehensive and interesting to both parties;
l) is able to become acquainted with other sub-areas of mathematical physics within a reasonable period of time;
m) is employable in those positions in which knowledge and research skills in the field of mathematical physics are required;
n) has sufficient knowledge of and insight in the role of mathematical physics order to

make a sound choice regarding one's own profession, as well as in the exertion of this profession.

o) is able to form a vision on the development of scientific research in the field of study.

Chapter 3. Admission to the programme

Article B-3.1 – Entry requirements

1. The Master's programme Mathematical Physics is a selective study programme.
2. Students who have successfully completed the double Bachelor's degree in *Wiskunde en Natuurkunde* awarded by the University of Amsterdam or by another Dutch University may be admitted.
3. Students who have successfully completed the following degrees may be admitted: the Bachelor's degree in *Natuurkunde* or *Natuur- en Sterrenkunde* or *Wiskunde* awarded by a Dutch university, with evident interest in physics and advanced mathematics. This interest must be made clear in a letter of application or during the intake interview.
4. 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 paragraphs 2 and 3.

Article B-3.2 – Premaster's programme

Without prejudice to the provisions of Article B-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 'conversion programme'. After completion of this conversion programme a letter of admission will be issued, exclusively for the stated Master's programme.

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

Not applicable.

Article B-3.4 – Intake dates

A request for admission to the programme must be submitted to the Faculty of Science and Master's programme before 1 July in the case of EU/EEA/Swiss (including Dutch students) students and before 1 February in the case of non-EU/EEA/Swiss students. Under exceptional circumstances, the Admissions Board may consider a request submitted after these intake dates.

Article B-3.5 – English Language Requirements

1. The proficiency requirement in English as the language of instruction can be met by the successful completion of one of the following examinations:
   - IELTS: 6,5, at least 6 on each sub-score (listening/reading/writing/speaking);
   - TOEFL paper-based: 580;
   - TOEFL Internet-based test: 92, at least 22 on each sub-score (listening/reading/writing/speaking);

   The foregoing examination must have been taken within two years before the student's enrolment.
   - C1 Advanced (CAE): minimal result 170
   - C2 Proficiency (CPE): minimal result 170

   Please note that the TOEFL-code for the University of Amsterdam is 9011.

2. An exemption from the English examination referred to in the first paragraph shall be granted to students who:
   - had previous education in secondary or tertiary education in one of the following English-speaking countries: Australia, Canada (English), New Zealand, Ireland, the United Kingdom or the United States of America;
   - hold an English-language 'international baccalaureate' diploma;
   - possessing a Bachelor's degree from a Dutch university satisfy the requirement of sufficient command of the English language;
   - passed the final examination for the subject of English as part of one of the following diplomas: VWO, Belgian ASO (Flemish).

Chapter 4. Content and organisation of the programme

Article B-4.1 – Organisation of the programme

The curriculum comprises the following:

Components	**EC (old style)**	**EC (new style)**
Compulsory courses	38	
Restricted-choice electives	28	66
Free-choice electives		12
Master Project Mathematical Physics	48	36
Master Seminar in Algebra and Geometry	6	6
Total EC	**120 EC**	**120 EC**

Students who enrolled on or before September 1, 2016 follow the old style programme. Students who enrol on or after September 1, 2017 follow the new style programme.
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.

Article B-4.2 – Compulsory components and restricted-choice electives

1. Master Seminar in Algebra, Geometry & Mathematical Physics. The content, format, and assessment criteria of the Master Seminar in Algebra, Geometry & Mathematical Physics are described in the Course Catalogue.
2. Master Project Mathematical Physics:
   a. The *Master Project Mathematical Physics* consists of a thesis, a midterm presentation in the *Master Seminar in Algebra, Geometry & Mathematical Physics*, and a final presentation. The assessment criteria are the quality and content of the written thesis (50%), the student's attitude and execution (35%), the midterm presentation (5%) and the final presentation (10%).
   b. At the end of the Master Project Mathematical Physics the supervisor (first examiner) checks on the basis of the assessment form, whether the student has sufficiently achieved the set exit qualifications.
   c. In the assessment of the Master Project Mathematical Physics
      i. An independent examiner will act as a second reviewer;
      ii. the coordinator of the Master Seminar will assess the midterm presentation;

iii. the final presentation will be attended by the supervisor and the second reviewer;
iv. the final grade of the master project will be determined in a private meeting by the supervisor and the second reviewer. A member of the Examinations Board will supervise the procedure.

3. Compulsory courses and restricted-choice electives are listed in appendix 1.
4. Compulsory courses (old style)
   Students take 30 EC of compulsory courses. The list for 2019/2020 is
   - Algebraic Topology 1, 8EC
   - Differential Geometry, 8 EC
   - Lie Groups, 8 EC
   - Topology in Physics, 6 EC
5. Restricted-choice electives (old style)
   From the restricted-choice electives, students take at least two from the list of physics courses. The list for 2019/2020 is:
   - Quantum Field Theory, 6 EC
   - Statistical Physics and Condensed Matter Theory I, 6 EC
   - String Theory, 6 EC
6. Restricted-choice electives (new style)
   a. Students take at least three courses out of
      - Differential Geometry, 8 EC
      - Algebraic Geometry 1, 8 EC
      - Algebraic Topology, 8 EC
      - Lie Groups, 8 EC
      - Lie algebras, 8 EC
      - Functional Analysis, 8 EC
      - Riemann Surfaces, 8 EC
      - Topology in Physics, 6 EC
   b. Students take at least three specialised mathematical physics courses. The list for 2019/20 is
      - Advanced Combinatorics: zeros of graph polynomials, Markov chains and algorithms, 8 EC
      - Algebraic Geometry 2, 8 EC
      - Algebraic Topology 2, 8 EC
      - Blowing Up and Deformations: an Introduction to the Theory of Singularities, 6 EC
      - Quantum Information Theory, 8 EC
      - Quantum Computing, 8 EC
      - Operator Algebras, 8 EC
      - Percolation: from Introduction to Frontiers of Current Research, 8 EC
      - Symplectic Geometry, 8 EC
      - Poisson Geometry, 8 EC
      - Random Walks, 8 EC
   c. Students take at least one from the list of physics courses. The list for 2019/20 is:
      - Quantum Field Theory, 6 EC
      - Statistical Physics and Condensed Matter Theory I, 6 EC
      - String Theory, 6EC

Article B-4.3 – Practical components

Not applicable.

Article B-4.4 – Elective components

1. Restricted-choice elective courses are listed in Appendix 1.
2. Course components successfully completed elsewhere or that are not included in the list of restricted-choice 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 has to be relevant to the programme.
   c. The courses have to be followed in the period that the student is enrolled in the programme.
3. In terms of content, restricted-choice 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. Regarding the free-choice elective components:
   In terms of content, free-choice 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-choice elective components as part of their programme. The Examinations Board will determine whether a free-choice elective component at the Bachelor's level will be accepted as part of the programme . A free-choice elective component will only be accepted as part of the programme if the Examinations Board has given its prior approval.

Article B-4.5 – Free curriculum

The student may compile a curriculum of his/her own choice, which has to be approved by the Examinations Board. The free curriculum must possess at least the extent, breadth and depth of a regular Master's programme and must be in line with the learning outcomes of the degree programme. At least one half of the proposed curriculum has to consist of components of the regular programme (see Article B-4.1), including the Master Seminar and the Master Project Mathematical Physics.

Article B-4.6 – Sequence and admission requirements

1. Participation in a compulsory or restricted-choice elective course may require particular mathematical prerequisites. The prerequisites for each course are listed in the Course Catalogue.
2. The Master Project in the regular programme can only be commenced if the compulsory course components and the restricted-choice elective components in the discipline are completed.

Article B-4.7 – Participation practical training and tutorials

Not applicable.

Article B-4.8 – Exemption

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

Article B-4.9 – 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 B-4.10 – Joint National Master's Programme

Students taking courses as part of Mastermath may also be subject to rules and regulations that have been agreed on nationally. These regulations can be found on: www.mastermath.nl -> 'General Rules & Guidelines'.

Article B-4.11 – Double Master's programme (two-year programmes)

In case a student combines two Master programmes of 120 EC and their components, the following requirements must be met in order to be awarded two Master's degrees:

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 examiners from the two Master's programmes. The project must be assessed as a pass by both examiners according to the standard and procedures for Master project assessment of the respective master degrees. The total number of credits given for an integrated research project cannot be more than 3/4 of the sum of the credits given for two independent research projects.
5. 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.

Chapter 5. Academic student counselling

Article B-5.1 – Academic student counselling

The academic student counselling for this programme consists of: master coordinators and study adviser.

Chapter 6. Teaching evaluation

Article B-6.1 – Teaching evaluation

Teaching evaluation shall take place as follows: UvA Q course evaluation system, assessment by Board of Studies, peer review, random quality assessment by the examination board.

Chapter 7. Transitional and final provisions

Article B-7.1 – 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 Programme Committee. 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 demonstrably does not damage the interests of students.

Article B-7.2 – Cancelled programme components and transitional provisions

1. The following course components of the past academic year have been cancelled:
   Lie Groups and Lie Algebras
   Geometric PDE
   Mirror Symmetry
   Symmetries and Conservation Laws of Nonlinear PDEs
2. These regulations apply to anyone enrolled in the programme. However, regarding the curriculum requirements as stated in Article B-4, the student may make an appeal to the regulations of the academic year of the student's enrollment in the programme.

Article B-7.3 – 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 B-7.4 – Effective date

These Regulations enter into force with effect from 1 September, 2019.
Thus drawn up by the Dean of the Faculty of Science on 27 August, 2019.

Appendix 1. Description of the content and study load of the components

Format: L: lectures; T: tutorials; PR: presentations; PROJ: Project
Assessment: W: written exam; O: oral exam; P: presentation; R: report

Course	code UvA	code VU	EC	period	format	ass.
Compulsory courses (old style, 30 EC). Part of the restricted-choice electives (new style)						
Algebraic Topology 1			8	1, 2	L, T	W, O
Differential Geometry	53348DIG8Y		8	1, 2	L, T	W, O
Lie Groups			8	1,2	L, T	W, O
Topology in Physics	5354TOIP6Y		6	4, 5	L, T	W, O
Restricted-choice electives						
Advanced Combinatorics: zeros of graph polynomials, Markov chains and algorithms			6	1,2		
Algebraic Geometry 1	53341ALG8Y		8	1, 2	L, T	W, O
Algebraic Geometry 2	53342ALG8Y		8	4, 5	L, T	W, O
Algebraic Topology 2	53342ALT8Y		8	4, 5	L, T	W, O
Blowing Ups and Deformations: an Introduction to the Theory of Singularities			6	4,5		
Functional Analysis	53348FUA8Y		8	1,2		
General Relativity	5354GERE6Y		6	1	L, T	W, O
Riemann Surfaces	53348RIS8Y		8	4, 5	L, T	W, O
Lie Algebras			8	4,5		
Operator Algebras	53348OPA8Y		8	4, 5	L, T	W, O
Partial Differential Equations	53348PAD8Y		8	1,2		
Percolation: from Introduction to Frontiers of Current Research	5334PITF8Y		8	4,5		
Poisson Geometry	5334POGE8Y		8	1,2		
Quantum Computing	5334QUCO8Y		8	4, 5	L, T	W, O
Quantum Field Theory	5354QUFT6Y	X_420081	6	2	L, T	W, O
Quantum Field Theory, extension	5354QFTE3Y	X_422554	3	3		
Quantum in Business and Society	5354QIBS3Y		3	6		

Quantum Information Theory	5334QUIT8Y		8	4, 5	L, T	W, O
Quivers	5334QUIV6Y		6	1, 2	L, T	W, O
Random Walks			8	1,2		
Reading course			3	1-6		
Reading course Mathematics	5334RECM6Y		6	1-6		
Statistical Physics and Condensed Matter Theory I	53541SPC6Y	X_420083	6	1	L, T	W
Statistical Physics and Condensed Matter Theory II	53542SPC6Y	X_420100	6	5	L, T	P, R
Statistical Physics and Condensed Matter, extension	5354SPCM3Y	X_420083	3	3		
String Theory	5354STTH6Y	X_400242	6	5	L, T	W
String Theory, extension	5354STTE3Y		3	6		
Symplectic Geometry	53248SYG8Y		8	4,5		
Topology of algebraic varieties			6	4,5		
Master Seminar (compulsory)						
Master Seminar in Algebra, Geometry and Mathematical Physics	5334MSIA6Y		6	1, 2, 4, 5	L, PR	P
Master Project (compulsory)						
Master Project Mathematical Physics (old style)	5342MPM48Y		48	1-6	PROJ	R
Master Project Mathematical Physics (new style)	5324MPM48Y		36-48 EC	1-6	PROJ	R