

# Appendices to Teaching and Examination regulations: Master's degree programme in Applied Mathematics

### Appendix I Teaching outcomes of the degree programme (art. 1.3)

The learning outcomes consist of general learning outcomes with respect to both knowledge and skills (which are applicable for the Master's degree programme in Mathematics as well) which are supplemented with programme-specific learning outcomes. For each learning outcome a reference to the Dublin descriptors is given between brackets.

The master graduate in Applied Mathematics:

- A1. has an understanding of the most important concepts of the field, [applying knowledge and understanding]
- A2. is able to contribute to the scientific advancement of a subfield of mathematics, [applying knowledge and understanding]
- A3. is able to use abstract thinking and mathematical modelling to get to the root of a problem and thus recognize whether existing methods are applicable, or to ascertain that new methods must be developed, [applying knowledge and understanding]
- A4. is able to function in multidisciplinary teams, [applying knowledge and understanding]
- A5. is familiar with the social and ethical aspects of applying mathematics in practice, [judgement]
- A6. understands the scientific relevance of problem definitions and results, and the validity of the scientific method, [judgement]
- A7. is able to describe solutions in both general and formal mathematical terms, [communication]
- A8. is able to express him- or herself well both orally and in writing, [communication]
- A9. is able to evaluate the scientific literature so as to keep their knowledge up to date. [learning]

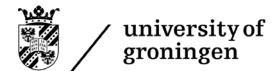
In addition, the master graduate in Applied Mathematics:

- T1. has general knowledge of the theories, methods and techniques in the field of applied mathematics, [knowledge and understanding]
- T2. has specialized knowledge in at least one of the following subfields of applied mathematics: [knowledge and understanding]
  - a. Computational Science and Numerical Mathematics
  - b. Systems, Control and Optimization,
- T3. has wide experience with the mathematical modelling of problems from actual practice, [applying knowledge and understanding]
- T4. has extensive experience with using the relevant mathematical tools. [applying knowledge and understanding]

## Appendix II Specializations of the degree programme (art. 2.2)

The degree programme has the following specializations:

- Computational Science and Numerical Mathematics
- Systems and Control



# **Appendix III Content of the degree programme** (art. 2.3)

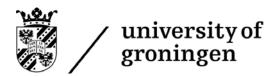
The degree programme has the following specializations:

- Computational Science and Numerical Mathematics
- Systems and Control

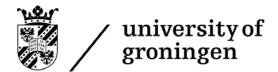
The master programme comprises 120 ECTS.

The requirements on the programme are the following.

| Parts                      | Constraints   | ECTS |
|----------------------------|---|------|
| Student colloquium         | Constraints   | 5    |
| At least five modules      | Specialization Computational Science and  | ≥ 25 |
| from the list of modules   | Numerical Mathematics :   |      |
| given at the University of | - Computational Fluid Dynamics (annual)   |      |
| Groningen, the modules     | - Computational Engineering (every two years,   |      |
| in the specialization area | 2014-2015)  |      |
| are compulsory             | - Boundary Layers (every two years, 2015-2016)  |      |
|                            | Specialization Systems and Control: - Robust Control (annual) - Modeling and Identification (every two years, 2014-2015) - Modeling and Control of Complex Nonlinear Engineering Systems (annual)  Specialization Algebra and Geometry (Mathematics): - Caput Algebra and Geometry (annual) - Geometry and Topology (every two years, 2015-2016) - Geometry and Differential Equations (every two years, 2014-2015) - Caput Differential Geometry (annual)  Specialization Dynamical Systems and Analysis (Mathematics): - Dynamical Systems and Chaos (annual) - Caput Dynamical Systems (every two years, 2014-2015) - Caput Mathematical Physics (every two years, 2015-2016) - Hamiltonian Mechanics (annual) |      |
|                            |   |      |



|                                | Specialization Statistics and Probability         |      |  |
|--------------------------------|---|------|--|
|                                | (Mathematics):                                    |      |  |
|                                | - Contemporary Statistics with Applications       |      |  |
|                                | (every two years, 2014-2015)                      |      |  |
|                                | - Statistical Genomics (every two years, 2015-    |      |  |
|                                | 2016)   |      |  |
| At least three modules         | From these modules at least two have to be in the | ≥ 18 |  |
| from the Mastermath            | specialization area and at least one has to be    |      |  |
| programme                      | outside the specialization area.                  |      |  |
|                                |   |      |  |
|                                | For information on the modules of the             |      |  |
|                                | Mastermath programme see: www.mastermath.nl       |      |  |
| Advanced modules of            | These modules have to be of at least third year   | ≥ 10 |  |
| programmes taught at the       | bachelor level, and have to be relevant for the   |      |  |
| <b>University of Groningen</b> | master Mathematics (at the discretion of the      |      |  |
| other than the master          | exam committee).                                  |      |  |
| programmes                     |   |      |  |
| mathematics and applied        |   |      |  |
| mathematics                    |   |      |  |
| Free choice                    |   | ≤ 5  |  |
| Final Research Project         | Research project in the specialization area. An   | 50   |  |
|                                | internship of at least 15 ECTS is part of this    |      |  |
|                                | project.  |      |  |



The Mathematics and Applied Mathematics modules given at the University of Groningen are

| module                              | offered   | ECTS | assessment                      | practical |
|-------------------------------------|-----------|------|---------------------------------|-----------|
| Caput Algebra and Geometry          | annual    | 5    | Take home exam followed by an   |           |
|                                     |           |      | oral discussion of the problems |           |
| Geometry and Topology               | every two | 5    | Written examination, homework   |           |
|                                     | years     |      | assignment                      |           |
| Geometry and Differential           | every two | 5    | Assignment with oral            |           |
| Equations                           | years     |      | presentation                    |           |
| Caput Differential Geometry         | annual    | 5    | Assignments, paper, oral        |           |
|                                     |           |      | presentation                    |           |
| <b>Boundary Layers</b>              | every two | 5    | Oral examination or written     | X         |
|                                     | years     |      | exam (if #students >5),         |           |
|                                     |           |      | assignment                      |           |
| Caput Dynamical Systems             | every two | 5    | Oral presentation, essay        |           |
|                                     | years     |      |                                 |           |
| Caput Mathematical Physics          | every two | 5    | Oral presentation, essay        |           |
|                                     | years     |      |                                 |           |
| Computational Engineering           | every two | 5    | Homework assignments,           | X         |
|                                     | years     |      | assignments, written exam       |           |
| <b>Computational Fluid Dynamics</b> | annual    | 5    | Assignments, oral examination   | X         |
| Contemporary Statistics with        | every two | 5    | Homework, examination           |           |
| Applications                        | years     |      |                                 |           |
| Dynamical Systems and Chaos         | annual    | 5    | Oral presentation, essay        |           |
| Hamiltonian Mechanics               | annual    | 5    | Homework assignments, Oral      |           |
|                                     |           |      | presentation, essay             |           |
| Final Research Project              | annual    | 50   | Assessment of performance,      |           |
| (P-variant only)                    |           |      | report, oral presentation       |           |
| Mathematical Research Project       | annual    | 30   | Assessment of performance,      |           |
| (M-variant only)                    |           |      | report, presentation            |           |
| Modelling and Identification        | every two | 5    | Take home exams followed by an  |           |
| _                                   | years     |      | oral discussion of the problems |           |
| Modeling and Control of             | annual    | 5    | Homework assignments, written   |           |
| Complex Nonlinear                   |           |      | examination                     |           |
| <b>Engineering Systems</b>          |           |      |                                 |           |
| Robust Control                      | annual    | 5    | Take home assignments, written  |           |
|                                     |           |      | exam                            |           |
| Statistical Genomics                | every two | 5    | homework assignments,           |           |
|                                     | years     |      | assigments, examination         |           |
|                                     | 1 -       | 1    | Oral presentation, article      |           |

For information on the modules of the Mastermath programme see http://www.mastermath.nl.

For information on the modules of programmes of the University of Groningen other than the master programmes mathematics and applied mathematics see the teaching and examination regulations of the corresponding programme.

# Appendix IV Optional modules (art. 2.4)

See Appendix III.

# **Appendix V Entry requirements and compulsory order of examinations**

(art. 3.2)

For students admitted to the programme there are no entry requirements for the individual modules.

# Appendix VI Admission to the degree programme and different specializations (art. 4.1.1 + art. 4.2)

Holders of the following Bachelor's degree from the University of Groningen are considered to have sufficient knowledge and skills and will be admitted to the Master's degree programme in Applied Mathematics:

- BSc Mathematics
- BSc Applied Mathematics

#### **Appendix VII**

# **Application deadlines for admission** (art. 4.7.1)

| Deadline of Application                 | Non-EU<br>students | EU students       |
|---|--------------------|-------------------|
| Nanoscience                             | February 1st 2015  | February 1st 2015 |
| Behavioural and Cognitive Neurosciences | April 1st 2015     | May 1st 2015      |
| Biomolecular Sciences (topprogramme)    | April 1st 2015     | April 1st 2015    |
| Evolutionary Biology (topprogramme/EM)  | January 15th 2015  | January 15th 2015 |
| Remaining FMNS Masters (amongst which   | April 1st 2015     | May 1st 2015      |
| Applied Mathematics)                    |                    | _                 |

# Decision deadlines (art. 4.7.3)

| Deadline of Decision                    | Non-EU        | EU students   |
|---|---------------|---------------|
|   | students      |               |
| Nanoscience                             | June 1st 2015 | June 1st 2015 |
| Behavioural and Cognitive Neurosciences | June 1st 2015 | June 1st 2015 |
| Biomolecular Sciences (topprogramme)    | June 1st 2015 | June 1st 2015 |
| Evolutionary Biology (topprogramme/EM)  | June 1st 2015 | June 1st 2015 |
| Remaining FMNS Masters (amongst which   | June 1st 2015 | June 1st 2015 |
| Applied Mathematics)                    |               |               |