

**Education and Examination Regulation**  
**2014 - 2015**  
**for the**  
**Applied Mathematics**  
**Master of Science programme**  
**University of Twente**  
**(Section 7.13 of the Higher Education and Research Act)**

**Foreword**

The Education and Examination Regulation specifies the content and set-up of the programme's curriculum. The Regulation is available for inspection at the Educational Affairs Office of Electrical Engineering, Mathematics and Computer Science and online on the programme website. The Regulation is adopted by the dean of the faculty (Section 7.13 of the Higher Education and Research Act)

Specific information on academic programmes and general information on interim examinations, final assessments, fraud and complaints-handling procedures is appended to this Regulation in ten appendices.

Both the general university section and the programme-specific section of the Student Charter of the University of Twente are available for inspection at the Educational Affairs Office of Electrical Engineering, Mathematics and Computer Science and online on the programme website, <http://onderwijs.math.utwente.nl/Onderwijs>.

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## Section 1                      General

### Article 1                      APPLICABILITY OF THE REGULATION

- a. This regulation applies to the curriculum and final assessments of the Applied Mathematics Master's Programme, hereafter referred to as: *the programme*.
- b. Responsibility for the programme lies with the Faculty of Electrical Engineering, Mathematics and Computer Science of the University of Twente (UT), hereafter referred to as: *the faculty*.
- c. Cases for which the Regulation does not provide shall be decided by the Board of Examiners of the programme.
- d. The Dean adopts the Regulation.

#### Article 1a – The authority to overrule the regulations

1. If the application of these regulations meets with objections of injustice and unfairness of overriding nature, the Examination Board has the authority to allow deviations of these regulations.
2. If the objections of injustice and unfairness occur in the application of these regulations w.r.t. admission to the programme while the Bachelor's degree still has to be taken), the Examination Board will refrain from the authority granted by Art. 1a.1. The mandate to allow deviations from these regulations in such cases is given to the Commissie Persoonlijke Omstandigheden.

### Article 2                      DEFINITION OF TERMS

Terms taken from the Higher Education and Research Act maintain the meaning established in the Act.

In this Education and Examination Regulation, the following terms are understood to mean:

- a. WHW: Higher Education and Research Act (*Wet op het Hoger onderwijs en Wetenschappelijk onderzoek*) in effect since 1 September 2002, including all applicable amendments;
- b. UT: University of Twente.
- c. dean: head of the faculty appointed by the Executive Board in accordance with Section 9.12, subsection 1, and Section 9.13, subsection 1, of the WHW;
- d. faculty council: advisory board of the Faculty of EEMCS, the authorities of which are outlined in Sections 9.37, 9.38, 9.38a and 9.38b of the WHW;
- e. programme: the Applied Mathematics programme, a Master of Science programme as referred to in Section 7.3a, subsection 1 under b of the WHW;
- f. programme management: administrative body of the programme as appointed by the dean in accordance with Section 9.17 of the WHW; all UT Master of Science programmes are managed by the programme director;
- g. programme committee: a committee instituted in accordance with Section 9.18 of the WHW which has an advisory role regarding matters of education in the programme;
- h. Board of Examiners: the Board of Examiners of the programme established in accordance with Section 7.12 of the WHW;
- i. study adviser: member of staff appointed or nominated by the dean to support students with all general study issues not directly related to their specific field of study;
- j. student: individual who is enrolled for education at the UT (as either a student or extraneous 'external' student) and who can potentially sit interim examinations and/or be considered for final assessment;
- k. graduation supervisor: chairholder of the chair chosen by the student to graduate from;
- l. cohort: group of students enrolled in the same Master's programme who begin in the same year
- m. final assessment: method by which the Board of Examiners can determine whether a student has sat all interim examinations for the relevant Master's programme units of study and whether the examination results satisfy the requirements established by it (in accordance with Section 7.10 of the WHW)
- n. unit of study: smallest independent assessment component for which unique objectives have been established, educational activities organised and an examiner appointed
- o. interim examination: evaluation of the student's knowledge, understanding and skills with regard to a specific unit of study and its assessment by at least one examiner appointed by the Board of Examiners
- p. credit: unit used to measure a student's study load; one credit is equal to 28 hours of study in accordance with Section 7.4, subsection 1, of the WHW
- q. examiner: individual appointed by the Board of Examiners to administer examinations, in

- accordance with Section 7.12 of the WHW
- r. transfer student: a student with a bachelor degree in Technical Mathematics from one of the Dutch technical universities
  - s. student entering through alternate route: a student who is not a transfer student
  - t. Bridging program. A bridging program is a program of courses defined by the Admissions Board that a prospective student can take as a minor program during a Bachelor's study, or as a pre-Master program
  - u.

### **Article 3            AIM OF THE MASTER'S PROGRAMME**

The programme aims to educate the students as competent researchers in Applied Mathematics and as academic professionals with the capacity and attitude to further develop him or herself in his/her future career.

The programme envisages educating mathematicians who will use mathematics from the perspective of applications in a social and multidisciplinary context and who can communicate effectively to others including the non-mathematicians.

The master graduates have the following competencies:

- a competence in the scientific discipline;
- b competence in doing research and modelling;
- c professional attitude;
- d academic reflection;
- e competence in communicating.

In working to achieve these competencies, attention is explicitly focused on alignment with both national and international standards, on reflection on science, technology and society (this is explored in the traineeship, for example, when students are expected to reflect on the working environment), on presentation and on the feasibility of the programme from the student's point of view.

The educational profile of the programme is characterised on the one hand by the three specialisations within the programme (see Article 8.2) and by the attention paid to mathematical modelling on the other. The three specialisations are engrafted on the corresponding three fields of research of the Applied Mathematics Department, which can be characterised by the following key words:

1. AACS: Mathematical Modelling of Waves, Neurodynamics, Inverse Problems in Seismology, Integrated Optics, Numerical Analysis, Turbulent Flows, Computational Fluid Dynamics. The chairs of this specialisation are Applied Analysis (AA), Mathematics of Computational Science (MACS) and Multiscale Modeling and Simulation (MMS)..
2. MASS: Nonlinear and Robust Control, Hamiltonian Modelling of Open Physical Systems, Hybrid Systems, Distributed-Parameter Systems, Stochastic Filtering and Control. The chair of this specialisation is Hybrid Systems.
3. OR: Combinatorial Optimisation, Mathematical Programming, Supply Chain Management, Queuing Theory, Telecommunications Networks, Industrial Statistics. The chairs of this specialisation are Stochastic Operations Research (SOR) and Discrete Mathematics and Mathematical Programming (DMMP).

Students choose a chair within a specialisation. During the final phase of the Master's programme, the students act as 'junior members' of the chair they have selected. It is during this phase that the students are given the greatest opportunity to demonstrate that they have acquired the qualities outlined in Article 4 by the time they complete their studies.

The focus on mathematical modelling is prevalent in various Master's courses (see Appendix 1), and especially in the traineeship and final project, combined or separately (see Appendices 6 and 7).

### **Article 4            ATTAINMENT TARGETS OF THE MASTER'S PROGRAMME**

The knowledge, understanding and skills students must have acquired upon completion of the programme are as follows:

1. Graduates have a broad and in-depth knowledge of mathematics and an insight into its application in different fields such as engineering, health sciences, ICT and business sciences.
2. Graduates are able to answer complex research questions with the help of different methodologies. When formulating and solving problems, graduates are capable of determining

whether the mathematical tools on hand suffice, and, if not, they are able to extend theories and methods themselves or otherwise are able to find such extensions in the professional literature.

3. Graduates are able to transcend the boundaries of their selected mathematical specialisation to a reasonable degree so that they can collaborate on interdisciplinary projects and also are able to formulate new problems in a scientific manner and to arrive at verifiable solutions.
4. Graduates are able to function in an engineering environment. Most importantly, they are able to apply mathematical methods and techniques and they have the capacity to integrate components from mathematics and different areas of application.
5. Graduates are able to search through, select, analyse the available literature independently and critically and use them in his or her research.
6. Graduates are capable of effective written and oral communication with others in the field as well as with laymen.
7. Graduates have an adequate comprehension of their role as academics in society and in-depth knowledge about the philosophy of science.
8. Talented graduates are able to choose to continue their studies by going for a PhD or another postgraduate programme (abroad if they choose).

#### **Article 5 FULL-TIME OR PART-TIME ORGANISATION OF THE PROGRAMME**

The Master's programme is full-time.

#### **Article 6 ADMISSION REQUIREMENTS OF THE MASTER'S PROGRAMME**

1. A confirmation of admission issued by the Board of Examiners must be submitted to be enrolled by the UT as a student of the programme.
2. Further details regarding the issuance of confirmations of admission as referred to in Article 6.1 are laid down by the Board of Examiners in the 'Examinations and Assessment Regulations' (RET).
3. In some cases, the admissions board will issue applicants a certificate of pre-Master admission. Students in this category must first successfully complete this pre-Master's programme to be fully admitted to the Master's programme and become fully enrolled students with all the associated rights.
4. Pre-Master admission is associated with a Bridging programme. A Bridging programme has a study load of 15EC or 30EC

#### **Article 7 LANGUAGE**

1. The language of the curricula of the Master's programmes is English. The interim examinations and final assessments are given in English.
2. In consultation with and with the approval of students, it may be decided to provide the curricula of a unit or an interim examination in Dutch.
3. The dean issues a regulation concerning the assessment of English language proficiency of staff members who teach courses in the programme, and of the support staff for the programme. All staff involved must meet the language requirements of the regulation. As necessary, courses to improve English proficiency of these staff members are provided.

## **Section 2 Curriculum and Final Assessment of the Master's Programme**

#### **Article 8 STRUCTURE OF THE MASTER'S PROGRAMME**

1. The Master's programme is divided into three specialisations. Each student chooses a specialisation and – within that specialisation – a course programme consisting of units of study. Appendix 1 lists all the Master's subjects that are part of the programme.
2. Students can specialise in:
  - a. Applied Analysis and Computational Science (AACS)
  - b. Mathematics and Applications of Signals and Systems (MASS)
  - c. Operations Research (OR)

3. The Master's programme is a two-year programme.  
The curriculum consists of the following elements:
  - a. A minimum of 18 ECs in common subjects (those with a tag 36 in the list in Appendix 1) wherein a minimum of 12 EC should be from the core subjects (with a tag 23).
  - b. A minimum of 5 EC in subjects on philosophy of science
  - c. In addition to a. a minimum of 25 EC in mathematics subjects of masters level so that the attainment targets of the programme is reached.
  - d. A minimum of 12 EC in national courses (offered via <http://www.mastermath.nl>)
  - e. Enough electives added to the above subjects so that the total number of ECs adds up to at least 60.
  - f. 20 EC on traineeship and 40 EC on final project.

The Master's programme for transfer students may contain a maximum of 10 ECs in subjects of bachelor level (from outside mathematics education) if expertise in that area is so desired, for example in the final project. Students entering the programme through an alternative route may not use more than 10 ECs from Bachelor level mathematics courses to satisfy the programme requirements.

Appendices 2 to 4 inclusive provide further details on the Master's programme for each specialisation.

National subjects are offered, co-ordinated by the Mathematics Co-ordination Group. See <http://www.mastermath.nl> for a list of these.

The examination rules and prerequisites are also posted on this website. These courses are offered in addition to the Master's courses offered as part of the programme. The courses mentioned in 8.3.c and 8.3.e may be replaced by similar courses from the national curriculum. Contrary to the provision 8.3.d, the Board of Examiners may allow 6 EC in national courses. The dispensation can, for example, be based on a better coherence of the master's programme in relation to the final project.

Alternative academic programmes are permitted in the second year (contrary to provision 8.3.f):

- a. Combined traineeship and final project (60 ECs), subject to a minimum of 3 and a maximum of 7 external months.

The rules and procedures governing the traineeship and the final project are specified in Appendices 5 and 6.

4. Students can create part of their own course programme using the units of study offered, with due observance of the provisions of Article 8.3. The course programme must be approved by the study adviser and graduation supervisor. For students entering the programme through an alternative route, this is done at the beginning, while transfer students must have an approved course programme by the time they have earned 18 credits. The study adviser is entitled to approve a later change to the programme that is not to exceed 6 credits without the course programme approval procedure needing to be repeated.
5. The units of study comprising the course programmes are annually determined for new students and, if necessary, changed for students further along in the degree programme. Each specialisation handled separately. This includes the scope and interrelation of units of study and the schedule of interim examinations. If changes are made, a transitional arrangement will apply to cohorts further along in the degree programme, in accordance with the provisions in Article 22.
6. Contrary to the provisions of 8.1 – 8.5, students can compile their own course programme (independent Master's programme). Such course programmes require the approval of the study adviser, graduation supervisor and the Board of Examiners. Before approving this programme, the Board of Examiners will confer with the programme committee.
7. Students with a bachelor degree which includes "educatieve minor met wiskunde tweedegraads lesbevoegdheid" may use the credits for electives, as stated in provision 8.3.e, and the 20 EC from the traineeship, as stated in provision 8.3.f, to form an alternate packet of 30 EC with didactical/pedagogical subjects, including a traineeship in a highschool, to obtain the "eerstegraads lesbevoegdheid wiskunde".

## **Article 9 FINAL ASSESSMENT OF THE MASTER'S PROGRAMME**

1. The programme concludes with the Master's programme final assessment.
2. The Master's programme final assessment comprises a study load of 120 credits.

3. Once the Board of Examiners has approved the selected specialisation and corresponding course programme on the basis of the regulation referred to in Article 8, the student can access the Master's programme final assessment.

## **Section 3 Interim Examinations**

### **Article 10 NUMBER, SCHEDULE AND FREQUENCY OF INTERIM EXAMINATIONS**

1. Interim examinations will be scheduled immediately following the conclusion of each unit of study. If circumstances prevent a unit of study from being offered during an academic year, the relevant interim examination will nonetheless be scheduled.
2. The Board of Examiners may instruct the examiner to schedule interim examinations on certain dates in addition to those provided for in Article 10.1.
3. Written interim examinations for the Master's programme will be scheduled for each unit at least twice each academic year, barring any of the exceptions outlined in Articles 10.5, 10.6, 10.7 and 10.8. The first interim examination will be scheduled immediately following the period during which the unit of study is offered, in accordance with the provisions of Article 10.1.
4. Contrary to the provisions of Article 10.3, but in accordance with the provisions of Article 10.1, at least one written internal examination date will be scheduled in an academic year during which the unit of study is not offered.
5. The provisions governing interim examinations of Articles 10.1, 10.3 and 10.4 do not apply to units of study subject to a transitional arrangement as referred to in Article 8.5. In these instances, the transitional arrangement will outline the scheduling of interim examinations in accordance with the provisions of Article 22.
6. Departures from the provisions of Articles 10.3 and 10.4 are permitted for units of study for which the designated examiner is not a member of staff of the Applied Mathematics department. In those cases, the provisions of the Education and Examination Regulation of the faculty or programme of the examiner's degree course shall apply.
7. In exceptional circumstances, the Board of Examiners may adopt regulations to schedule written interim examinations in a manner departing from the provisions of Articles 10.3, 10.4 and 10.6.
8. A schedule of written interim examinations for a semester will be published at least one month in advance of the start of that semester.
9. Students may only sit interim examinations if they register for them. The examination schedule indicates closing dates for interim examination registration.
10. This Article's provisions governing written interim examinations do not apply to units of study not or not exclusively assessed by means of a written interim examination. In instances where the scheduling of interim examinations is not covered by this Article, the student can, after sitting an interim examination and receiving the results from the examiner, submit a request to re-sit the interim examination.
11. If a student has failed two or more units in the first year of the programme, the study adviser can apply to the Board of Examiners for a Make-up Study. This Make-up Study is a contract between the lecturers and student concerned, stipulating what requirements the student must meet to obtain satisfactory results for the specific units. It must be possible to complete these requirements in a four-week period during the summer, and seven is the maximum mark on the grading scale for the specific units of study.
12. The student can choose to accept or decline the offer of Make-up Study (as defined in section 11). If the student accepts the offer, the study adviser ensures that clear agreements are made between the student and examiner or examiners regarding the completion of the Make-up Study.
13. If a subject with a written interim examination is cancelled, another two written interim examinations must be offered the following academic year.

### **Article 11 SEQUENCE OF AND ELIGIBILITY FOR INTERIM EXAMINATIONS**

1. Students who have a confirmation of admission as referred to in Article 6.1 may sit interim examinations.



2. If requested, the Board of Examiners may permit students to sit interim examinations for the programme even if the students have not been granted admission to the programme as referred to in Article 11.1.
3. The provisions of Articles 11.1 and 11.2 do not apply to students who complete a unit of study and sit an interim examination as part of a degree course other than the programme covered by this Education and Examination Regulation. For these students, the rules governing sitting interim examinations laid down in their own degree course's Education and Examination Regulation apply.
4. The Board of Examiners can adopt regulations governing basic knowledge requirements, barring students from interim examinations as long as they fail to successfully complete certain units of study. These regulations are laid down each year and posted in OSIRIS.
5. In individual instances, the Board of Examiners may prevent a student from sitting some or all interim examinations for a limited period of no more than one year if it feels a student has committed a serious breach of the rules governing sitting interim examinations. The relevant regulations and procedures are laid down in the 'Examinations and Assessment Regulations' (RET)..
6. A student who fails to register for a written interim examination may be refused entrance to the examination session and, consequently, be unable to sit the interim examination.

#### **Article 12      VALIDITY OF INTERIM EXAMINATION RESULTS**

1. The units of study completed have unrestricted validity.
2. If a unit of study's interim examination comprises individually graded sub-examinations (i.e. an interim examination sat in parts), the examiner will determine the term of validity of the relevant sub-results. If students have not been notified of the term of validity of sub-results by the time the unit of study starts, the sub-results will remain valid until such time as the specific unit of study is eliminated or modified to such an extent that a transitional arrangement as referred to in Article 22 becomes applicable.

#### **Article 13      SITTING INTERIM EXAMINATIONS**

1. The procedures for sitting interim examinations reviewed as part of a Master's programme final assessment are laid down each year for each new cohort and, if necessary, changed for cohorts further along in the degree programme. A transitional arrangement will be established for any changes made for cohorts further along in the programme, in accordance with the provisions of Article 22.
2. The interim examinations procedure for the units of study is posted on OSIRIS.
3. The designated examiner may – unilaterally or on the instruction of the Board of Examiners – opt to use forms of examination other than those established and published in accordance with the provisions of Articles 13.1 and 13.2. The form of examination ultimately chosen, however, should serve to facilitate the progress of the student/students involved and not negatively impact the quality of the assessment.
4. If an interim examination comprises individually graded sub-examinations (i.e. an interim examination sat in parts), the examiner should – prior to or at the start of the subject – inform the students in writing or electronically how the sub-results will be used to determine the final interim examination result.
5. The programme ensures that for every (sub-)examination information is available about its form, level and grading. This will be done, for example, by making a model exam, a representative old exam or a collection of representative exercise problems (including the scheme of grading) available to the students.
6. Students with a physical or sensory handicap will be given the opportunity to sit interim examinations and complete practical exercises in a manner appropriate to their ability. This can be achieved by, for instance, adjusting the type or duration of the interim examinations or providing practical tools, tailored to the student's situation. Students wishing to invoke these regulations should contact their study adviser or, in cases of dyslexia, the Educational Affairs Office.

#### **Article 14 ORAL INTERIM EXAMINATIONS**

1. The examiner may conduct oral examinations involving more than one student at a time, unless one of the students involved objects to this.
2. Oral interim examinations are open to the public, except in special cases when the Board of Examiners has decided otherwise.
3. If the student or the examiner wants the presence of a third person during the oral examination, the Board of Examiners must be informed about it at least 10 days before the day of the oral examination.
4. If the Board of Examiners wants the presence of one of her member or an observer on behalf of her during the oral examination, the student and the examiner must be notified about it at least one day in advance of the oral examination.

#### **Article 15 DETERMINATION AND PUBLICATION OF RESULTS**

1. Immediately after conducting the oral interim examination, the examiner determines the results, explains these and provides the student with a written confirmation of the results.
2. The examiner determines the official results of a written interim examination as quickly as possible, but no later than 15 working days after administering it. The examiner provides the Educational Affairs Office with the necessary information and ensures that the written statement is provided. The Educational Affairs Office ensures that the results are registered no later than 20 working days after the examination is sat. University holidays and public holidays recognised by the UT will not count as working days. The Board of Examiners can make an exception to the stated periods. Students must be informed before the examinations are administered.
3. If two written interim examination sessions for the same unit of study are scheduled shortly after each other, the term during which the examiner determines the result will be reduced so that the results from the first examination date will be announced before registration for the second examination date closes.
4. For other forms of evaluation (i.e. other than oral or written examinations), the examiner will – if requested – indicate how the result will be determined and when the student will be informed of the result. The Board of Examiners can – unilaterally or at the request of students – instruct the examiner to observe a term it establishes for the announcement of results.
5. If there are more than one valid results for a unit of study, the highest result will be considered valid.

#### **Article 16 RIGHT OF INSPECTION**

1. During a period of 12 months starting on the day after being informed of the results of a written interim examination, the examinee may request to inspect his/her marked interim examination. The examiner designated, if any, for the subject in question will bear responsibility for this. This provision also applies to the inspection of reports for practical exercises. The individual in charge of the practical exercise determines: a) whether the reports will be returned to the student involved after the 12-month period and b) whether the student may make photocopies or other copies of the graded reports.
2. During a period of 12 months starting on the day after the results of an interim examination are announced, interested individuals may inspect the questions and assignments included or given in the written interim examination administered and the standards on the basis of which the evaluation occurred. The examiner determines whether photocopies may be made.
3. The place and time of the inspection referred to in Articles 16.1 and 16.2 will be determined by the examiner in consultation with the examinee.

#### **Article 17 MEETING TO DISCUSS INTERIM EXAMINATION RESULTS**

1. If requested to do so, the examiner will meet with students to discuss a written interim examination, provided the request is submitted within 12 months of the day on which the results were announced. The examiner will determine a time and location for the meeting within a reasonable amount of time after receiving the request.
2. The Board of Examiners may grant exceptions to the provisions of Article 17.1.

## **Section 4 Exemption from Interim Examinations**

### **Article 18 EXEMPTION FROM INTERIM EXAMINATIONS AND/OR PRACTICAL EXERCISES**

1. The Board of Examiners may grant an exemption for one or more interim examinations and/or practical exercises on the basis of written certificates for higher education interim examinations or examinations the student has successfully sat in the past or certificates for competencies acquired previously in a non-higher education context. Exemptions are not granted for a Bachelor's programme. If compulsory Master's subjects have been completed already (for the most part) as part of a Bachelor's programme, these can be replaced by other subjects.
2. A request for an exemption from one or more interim examinations of a unit must be submitted in writing to the Board of Examiners. This request must be accompanied by copies of all relevant documents indicating the basis for the exemption being requested.

## **Section 5 Examinations**

### **Article 19 SCHEDULE AND FREQUENCY OF FINAL ASSESSMENTS**

1. Students will have at least three opportunities a year to have the programme's final assessment conducted.
2. Registration is required to have a final assessment conducted. The Board of Examiners' meeting schedule is set and published at the start of each academic year. The exact dates are made known at least 10 weeks before the meeting.
3. The rules governing registration for and performance of final assessments, determination of the results and the awarding of diplomas are laid down in the 'Examinations and Assessment Regulations' (RET).

## **Section 6 Student Support Services and Academic Advice**

### **Article 20 STUDY PROGRESS REPORT**

1. Each year, all students will receive at least one update in writing, outlining their study progress in the last period.

## **Section 7 Provisions Regarding Implementation**

### **Article 21 REGULATION AMENDMENTS**

1. Amendments to this Education and Examination Regulation will be adopted by the dean by means of a separate decision.
2. Amendments affecting the current academic year may be implemented, provided they do not unreasonably impinge on the students' interests.
3. Amendments may not negatively impact decisions taken – pursuant to this Education and Examination Regulation – by the Board of Examiners with regard to a student.

### **Article 22 TRANSITIONAL ARRANGEMENTS**

1. If substantive changes are made to the degree course's structure and composition, including situations in which one of the articles of the Education and Examination Regulations is amended, the dean will establish and announce a transitional arrangement. These arrangements are set out in Appendix 7.

This transitional arrangement will in any event:

- a. outline a scheme governing the granting of exemptions for previous results of interim examinations
- b. indicate the number of times interim examinations for the units of study of the old degree course may be re-sat
- c. indicate the term of the transitional arrangement

2. The following applies to establishing and announcing a transitional arrangement for amendments to a unit of study:
  - a. If a unit of study reviewed by means of a written or oral examination is terminated, a student must have at least one more opportunity to sit the interim examination for the unit of study in question in the academic year after the unit of study is offered for the last time.
  - b. If the curriculum or learning objective of a unit of study reviewed by means of a written or oral examination undergoes substantial change or the form of examination involved is significantly changed, a student must have at least one more opportunity to sit the interim examination for the unit of study in question in the 'old' manner in the academic year after the unit of study is offered in its unmodified form for the last time.
  - c. If a unit of study to be terminated is reviewed on the basis of the quality of participation in activities and any work produced (particularly project-oriented subjects) and not or only partially based on a written or oral examination, the Board of Examiners will determine how a student will be able to satisfy the interim examination requirements if he has not yet completed the unit of study in question.

#### **Article 23      PUBLICATION**

1. The dean adopts this Education and Examination Regulation after consulting with the programme committee and after approval from the faculty council.
2. The dean and the programme committee regularly evaluate the implementation and effectiveness of this Education and Examination Regulation.
3. The dean ensures that this Education and Examination Regulation and any interim amendments are made known.

#### **Article 24      ENTRY INTO FORCE**

This Education and Examination Regulation takes effect on 01 September 2014.

**Adopted by the dean of the Faculty on ....  
as proposed by programme management and Boards of Examiners,  
after receiving the recommendations of the programme committee (, 20143), approved by the  
Faculty Council on**

.....

## Appendix 1 Overview of Master's Programme Subjects 2014-2015

The table below lists the Master's programme subjects offered by the chair as chair subjects. These subjects are given at UT or offered nationally with the involvement of a UT lecturer. Besides the subjects listed in the table below, there are other national subjects that can be taken as electives as part of a Master's programme. The total range of national subjects offered can be found at [www.mastermath.nl](http://www.mastermath.nl)

Code	Course	Quartile				EC	Chair
		1	2	3	4		
191506302	Applied functional analysis	23, 36				6	AA
191509103	Advanced modelling in science			2N		6	AA
191511430	Seminar mathematical physics	X	X	X	X	5	AA
191550105	Theory of partial differential equations		X			5	AA
201200219	Partial differential equations II				X	5	AA
191560430	Nonlinear Dynamics		X			5	AA
191521800	Game theory	X				5	DMMP
191580800	Scheduling			2N		6	DMMP
191581100	Discrete optimization	2N, 36				6	DMMP
191581200	Continuous optimization	2N, 36				6	DMMP
191581420	Optimization modelling			X		5	DMMP
201200207	Capita selecta operations research				X	5	DMMP
191560671	Robust control			X		5	HS
191561560	Systems and control	2N				6	HS
191561620	Optimal control			X		5	HS
191571200	Hybrid dynamical systems				X	5	HS
201200155	Partial differential equations I			X		6	MACS
191551150	Numerical techniques for pde		X			5	MACS
191551161	Applied finite element methods for pde			2N		6	MACS
191551200	Scientific computing			23, 36		6	MACS
191521800	Game theory	X				5	SOR
191531750	Stochastic processes	23, 36				6	SOR
191531870	Queueing theory			2N		6	SOR
191531920	Markov decision theory		X			5	SOR
191531940	Network of queues				X	5	SOR
201200207	Capita selecta operations research				X	5	SOR
191531400	Applied statistics			2N		6	
191570401	Measure and probability	36				6	
201200135	Random signals and filtering			X		5	HS
191571090	Time series analysis	X				5	HS
191571501	Stochastic differential equations			2N		6	HS

23	choice of 2 out of 3 (3TU core programme)
36	choice of 3 out of 6 (common subjects)
2N	choice from the national courses (to be found at <a href="http://www.mastermath.nl">http://www.mastermath.nl</a> )
AA	Applied Analysis
DMMP	Discrete Mathematics and Mathematical Programming
HS	Hybrid Systems
MACS	Mathematics of Computational Science
SOR	Stochastic Operations Research

## Appendix 2 Applied Analysis and Computational Science Programme 2014-2015

**Chairs: Applied Analysis,  
Mathematics of Computational Science and  
Multiscale Modeling and Simulation**

Intended for: transfer students who start the Master's programme in the 2013 – 2014 academic year.

Programme requirements: the course section of the Master's programme will certainly consist of:

- three common subjects (C),
  - five mathematics subjects (relevant for this specialisation),
  - one course on Philosophy of Engineering
- plus electives so the entire course programme adds up to at least 60 ECs and at least two of the national courses (2N) are selected.

These programme requirements result in the following (compulsory) course programme.

Code	Course	Quartile				EC	Remark
		1	2	3	4		
191506302	Applied Functional Analysis	x				6	C
191551200	Scientific Computing			x		6	C
191570401	Measure and Probability	x				6	C
191616040	Philosophy of Engineering		x		x	5	
191551150	Numerical Techniques for PDE		x			5	
191551161	Applied Finite Element Methods for PDE's			x, 2N		6	
191560430	Nonlinear Dynamics		x	x		5	
201200155	Partial Differential Equations I			x		6	
201200219	Partial Differential Equations II				x	5	

2N	Choice from the national courses
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The electives are applied physics/technology subjects on Optics, Fluid Mechanics, Biomathematics or other mathematical subjects that may be offered nationally. These subjects are determined in consultation between the student and the respective chair holder. The choice depends on the student's interests and the topic of the final project.

It is also possible for the traineeship (20 ECs) to be used to delve more deeply into specific subject matter.

Students entering the programme through an alternative route: They are asked to contact the study adviser as soon as possible in order to determine a suitable programme that is feasible from the student's point of view.

A list of possible elective courses are given below. This list is not exhaustive. It gives only an indication about available courses.

Course	Quartile				EC	Comment
	1	2	3	4		
Capita Selecta AACS (Seminar Mathematical Physics)	X	X	X	X	5	Applied Math course
Time Series Analysis	X				5	Applied Math course
Continuous Optimization		X			5	Applied Math course
Stochastic Differential Equations			X		6	National
Advanced Modeling in Science			X		6	National
Dynamic Behavior of Neuronal Networks				X	5	
Advanced Fluid Mechanics	X				5	
Mathematical Biology		X			8	National (if available)

## Appendix 3 Mathematics and Applications of Signals and Systems Programme 2014-2015

### Chairs: Hybrid Systems

We offer a two-year MSc programme. The programme is designed for students with an undergraduate degree in fields such as mathematics, physics, engineering, econometrics or computer sciences. The first year consists of courses, while most of the second year is dedicated to a traineeship and a graduation project.

The first year is divided into 4 quartiles and entails 10–12 courses of 5 or 6 ECs per course. The number of courses in the second year is flexible (possibly zero). Some of the courses are compulsory.

Code	Course	Quartile				EC	Chair
		1	2	3	4		
191561560	Systems and Control	56, 2N				6	HS
191560671	Robust Control			56		5	HS
191571200	Hybrid Dynamical Systems				56	5	HS
191571090	Time Series Analysis and System Identification	56				5	HS
201200135	Random Signals and Filtering			56		5	HS
191571501	Stochastic Differential Equations			56, 2N		6	HS
191616040	Philosophy of Engineering		x		x	5	
191506302	Applied Functional Analysis	23, 36				6	
191531750	Stochastic Processes	23, 36				6	
191551200	Scientific Computing			23, 36		6	
191570401	Measure and Probability	36				6	
191581100	Discrete Optimization	36, 2N				6	
191581200	Continuous Optimization	36, 2N				6	
191509103	Advanced Modelling in Science			2N		6	AA
191551161	Applied Finite Element Methods for PDE's			2N		6	MACS
191531400	Applied Statistics			2N		6	
191531870	Queueing Theory			2N		6	SOR

23	Choice of 2 out of 3
2N	Choice from the national courses
36	Choice of 3 out of 6
56	Choice of 5 out of 6



Other courses may be chosen from the tentative list below. This list is not complete but gives a good indication of what is available. The choice depends on your background and preferences and the content of the graduation project.

Course	Quartile				EC	Comment
	1	2	3	4		
Optimal Control			X		5	Applied Math course
Modeling and Analysis of Concurrent Systems 1	X				5	Computer Sciences course
Modeling and Analysis of Concurrent Systems 2		X			5	Computer Sciences course
System Validation				X	5	Computer Sciences course
Advanced Digital Signal Processing				X	5	Electrical Engineering course
Control Engineering			X			Electrical Engineering course
Digital Control Engineering		X			5	Electrical Engineering course
Engineering System Dynamics			X		3	Electrical Engineering course
Modeling and Simulation		X				Electrical Engineering course
Modern Robotics				X	5	Electrical Engineering course
Biological Control Systems	X					Technical Medicine course
Infinite Dimensional Systems						National (if available)
Nonlinear Systems Theory						National (if available)

## Appendix 4 Operations Research Programme 2014-2015

The specialisation Operations Research within the Master's programme in Applied Mathematics focuses on Mathematics of Operations Research and is offered by the chairs Discrete Mathematics and Mathematical Programming, and Stochastic Operations Research.

The track consists of a one-year course programme, followed by one year of practical training (traineeship), and graduation (final project). It is possible to include some courses in the programme for the second year.

### Requirements

Course load : 60 ECs  
 Traineeship : 20 ECs  
 Thesis : 40 ECs

#### Coursework:

One compulsory course:

191616040 : Philosophy of Engineering (Quartile 2 and 4) : 5 EC

Three courses from the 3TU mathematics core programme

Code	Course	Quartile				EC
		1	2	3	4	
191570401	Measure and Probability	36				6
191506302	Applied Functional Analysis	23, 36				6
191531750	Stochastic Processes	23, 36				6
191551200	Scientific Computing			23, 36		6
191581100	Discrete Optimization	2N, 36				6
191581200	Continuous Optimization	2N, 36				6

Five courses from the OR programme selection list

Code	Course	Quartile				EC
		1	2	3	4	
191521800	Game Theory	X				5
191531940	Networks of Queues				X	5
191531920	Markov Decision Theory		X			5
201200207	Capita Selecta Operations Research				X	5
191531870	Queueing Theory (LNMB)				2N	6
191580800	Scheduling (LNMB)				2N	6
191581100	Discrete Optimization (LNMB)	2N, 36				6
191581200	Continuous Optimization (LNMB)	2N, 36				6
191581420	Optimization Modelling			X		5

23	Choice of 2 out of 3
2N	Choice from the national courses
36	Choice of 3 out of 6

Remaining course load: free selection from

National master courses mathematics (mastermath)  
 Master's courses at other programmes and at other universities  
 PhD courses

## Appendix 5                      The Traineeship

### TRAINEESHIP

The 20-credit traineeship is completed over at least a three-month period. The student spends the time in an off-campus work setting. UT is only eligible as a traineeship host in exceptional cases, at the discretion of the study adviser, graduation supervisor and Board of Examiners. During the traineeship, the student performs work determined by the host organisation and in line with the organisation's aims. The work must also be related to the programme both in terms of substance and level. The primary aims of the traineeship are for the student to:

- discover how to practically apply the knowledge and skills gained from the programme
- learn how to work with colleagues within an organisation and work in accordance with the rules and preconditions applicable to and deemed important by the organisation

At the conclusion of the traineeship, the student submits a written report about his/her traineeship.

### PRIOR TO THE TRAINEESHIP

1. The student contacts the traineeship co-ordinator at least six months before the student wants to start the traineeship in the Netherlands. For traineeships abroad, the student must contact the traineeship co-ordinator about 1 year before the traineeship is required.
2. The traineeship co-ordinator can assist in finding an appropriate placement, taking into consideration – as much as reasonably possible – the student's wishes in terms of, for instance, the type of assignment, type of company, regional placement and term of the traineeship. The traineeship will be geared as much as possible to the student's chair.
3. Lecturers may assist the student in finding a suitable placement or the student may find one by himself/herself.

### TRAINEESHIP ADMISSION

The programme has a Traineeship Office to handle the various issues relevant to traineeships. The traineeship must be reported to and registered with this office. The following matters must be arranged by the graduation supervisor (or someone designated by the supervisor).

1. The supervisors, TW traineeship mentor and company mentor are designated (see Supervision).
2. The traineeship job description has been assessed and approved by the TW traineeship mentor.
3. Prior to starting the traineeship, the student must have a Bachelor's diploma, a course programme signed by the study adviser and a minimum of 40 credits of the programme completed.

### SUPERVISION

Two supervisors are designated before the student leaves for the traineeship location:

the company mentor: a member of the staff of the company who assists and evaluates the student at the company.

the TW traineeship mentor: the traineeship lecturer, who assists with and evaluates the curricula of the traineeship.

### EVALUATION

THE TW traineeship mentor determines a grade for the traineeship after receiving the report. The company evaluation is also taken into consideration. The traineeship co-ordinator verifies whether the report meets the requirements.

## Appendix 6 The Final Project

### FINAL PROJECT

There are two types of final projects. The final project is either carried out separately (40 EC) or in combination with the traineeship (60 EC). The traineeship is completed over a period of at least three months but no more than seven months. Students complete traineeships off-campus. Only in exceptional cases students may work as trainees at the University of Twente, such to be decided by the study adviser, the graduation supervisor and the Board of Examiners.

The final project must enable the student to apply the expertise gained during prior courses, projects and practical training sessions to solve well-defined problems of sufficient academic difficulty. In completing the final project, students must be allowed to make their own decisions. Students must be able to address the problem systematically, achieve clear results and formulate clear conclusions. Students are expected to report, both orally and in writing, on their findings and read and process relevant literature critically.

Students who choose the combined traineeship and final project may use part of their credits to focus on the project theme before leaving and work on their report after their return.

At the beginning of the final project, the student and the graduation supervisor make work agreements. The graduation supervisor ensures that the assignment is in line with the 'mission' of the student's chosen specialisation and arranges for adequate supervision.

The student will meet with the supervisors regularly to discuss the progress of the final project. These meetings focus on both the content and the implementation of the final project (comparable to the job appraisal interviews students will encounter later in their career).

To complete the final project, the student must submit a written report and hold a public presentation.

### GRADUATION COMMITTEE AND EVALUATION COMMITTEE

The regulations about the composition of the graduation committee and the evaluation committee are laid down by the Board of Examiners in the 'Examinations and Assessment Regulations' (RET).

### FINAL PROJECT ADMISSION AND ELIGIBILITY

The student contacts a chair willing to take responsibility for the development, organisation and supervision of the project and/or an external organisation where the project can be performed. The study adviser can help find a chair. The chair can be of assistance in making arrangements with external organisations. The following conditions must be met prior to definitive admission to the final project:

- The study adviser has approved the student's course programme.
- A chair/chairs willing to take responsibility for the organisation, supervision and assessment of the graduation project has/have been found.
- Outside of the final project or combined traineeship and final project, the student requires no more than 10 credits to be eligible for the Master's programme final assessment.

### RULES FOR SUPERVISING AND EVALUATING FINAL PROJECT

The graduation supervisor is responsible for ensuring that there is proper supervision and evaluation during the course of the final project.

One part of supervising would-be graduates is to create a graduation file where correspondence between the student and graduation committee is saved, along with the agreements made as a result. The student ensures that his or her file includes reports of any obstacles beyond the student's control that he or she has encountered while working on the final project, such as special personal circumstances, changes at the company where the student is performing his/her project, inadequate facilities or requisite information not being available on time. The graduation committee and supervisors ensure that work schedules and all additional agreements with the student are kept in the file. In particular, the file also includes work done in advance of the student's departure for the traineeship location as part of a combined traineeship and final project. During the final evaluation of the final project, explicit consideration is given to the work included in the file but the report does not necessarily have to describe that work in detail.

No later than 5 weeks before the final project is due, the student and graduation committee confer on the project's status. A report of this meeting is saved in the file and states the project due date (rescheduled if necessary), as well as any corrective changes to the project description and supervision. The student confirms that he or she approves of the report and the updated agreements. Any time an extension of more than a month is granted (not including holiday periods), a new report is inserted in the file no less than three weeks before the extension is to expire.

## Appendix 7 Transitional Arrangements

1. Rule regarding valid grade (highest versus latest)

**Motivation:** Change of rule starting from cohort 2009

**Validity:** This arrangement is valid for unlimited time

**Agreement:**

While applying article 15.5 to decide about a valid grade for a unit of study for which sittings have taken place before 1 September 2009, the grade that was valid on 31 August 2009 will be considered. The new rule is not applicable to those previous sittings.

2. Rule regarding passing the final assessment

**Motivation:** Change of rule starting from cohort 2011

**Validity:** This arrangement is valid for unlimited time

**Agreement:**

Contrary to article A3 of Appendix A (Fail/Pass Guidelines) of the Examination and Testing Regulations, a student who started the programme before 1 September 2011 may pass the final assessment with (at most) one five and no marks under five in the list of marks, provided the average of the marks is at least six. In this case the student would not be considered for the qualification 'with honours'.

3. Rule regarding the specialisation Financial Engineering for students of cohort 2011 or before

**Motivation:** Discontinuation of Financial Engineering from 2012-13

**Validity:** This arrangement is valid for unlimited time

**Agreement:**

A student who has started the programme with specialisation Financial Engineering before 1 September 2012 may continue to earn his/her master's diploma with the programme which is already approved, including the (alternative) academic activities in the second year, namely, 30 EC coursework and 30 EC for combined traineeship and final project.