**ANNEX TO THE TEACHING AND EXAMINATION REGULATIONS FOR THE BACHELOR'S PROGRAMME IN APPLIED MATHEMATICS**

The rules in this Annex are part of the programme portion of the Student Charter, including the Teaching and Examination Regulations for the Bachelor's programme in Applied Mathematics offered by the Faculty of Electrical Engineering, Mathematics and Computer Science of the University of Twente.

**CONTENTS**



# PART 1 IMPLEMENTATION[1] OF ARTICLES 3.1 AND 3.2, PARAGRAPH 3

## **a**. The content of the programme and the associated examinations

Students who started on the programme in September 2013 or later will pass the final Bachelor's degree audit for Applied Mathematics once they have passed all study units as listed in Tables 1, 2 and 3.
Students who started on the programme prior to 1 September 2013 will pass the final Bachelor's degree audit for Applied Mathematics once they have passed all study units as listed in Tables 4, 5 and 6. These study units are no longer offered, so these students will have to avail themselves of the transitional arrangements in Part 3 of this Annex.
Table 7 in Part 2 of this Annex contains a curriculum that has been adjusted for the combined final degree audit for Applied Physics and Applied Mathematics.
Table 8 in Part 2 of this Annex contains a curriculum that has been adjusted for the combined final degree audit for Technical Computer Science and Applied Mathematics.

[1] The letters associated with the various paragraphs refer to the same letters in Article 7.13, paragraph 2 of the Higher Education and Research Act (WHW).

**Table 1[2]: the first academic year for cohorts starting in 2013 or later**

| | *Study load in EC* | *Teaching method* | *Form of assessment* | *Sequence requirements* |
|---|---|---|---|---|
| **201300056 Structures and Models** | 15 | | | - |
| *Components: Mathematics A + β1* | | Lec+Tu | W | |
| *Linear Structures I* | | Lec+Tu | W | |
| *Programming and Modelling* | | Lec+PR | Pj+P | |
| *Includes: Intercultural Communicator workshop* | | | | |
| **201300057 Techniques for Mathematical Proofs** | 15 | | | - |
| *Components: Mathematics β2,* | | Lec+Tu | W | |
| *Linear Structures II* | | Lec+Tu | W | |
| *Analysis* | | Lec+Tu | W | |
| *Linear Optimization* | | Lec+Tu | W | |
| *Proof lab* | | PR | W+Or | |
| **201300182 Signals and Uncertainty** | 15 | | | - |
| *Components: Signals & Transformations* | | Lec+Tu | W | |
| *Probability* | | Lec+Tu | W | |
| *Project* | | PR | Pj | |
| *Includes: Intercultural Team workshop* | | | | |
| **201400535 Fields and Electromagnetism** | 15 | | | - |
| *Components: Vector calculus* | | Lec+Tu | W | |
| *Electromagnetism* | | Lec+Tu | W | |
| *Project* | | Lec+PR | Pj+P | |
| **Entire academic year** | 60 | | | |

[2] Section 1 explains the abbreviations used in the columns 'teaching method' and 'form of assessment'. Numbers in the column 'sequence requirements' refer to the text following the table.

**Table 2[3]: the second academic year for cohorts starting in 2013 or later**

| | *Study load in EC* | *Teaching method* | *assessment* | *Sequence requirements* |
|---|---|---|---|---|
| **201400218 Statistics and Analysis** | 15 | | | - |
| *Components: Statistics* | | Lec+Tu | W | |
| *Analysis II* | | Lec+Tu | W | |
| *Presentation Skills* | | Lec+PR | Pr | |
| *Project* | | PR | Pj | |
| **201500103 Dynamic Systems** | 15 | | | - |
| *Components: Differential equations and Numerical Mathematics* | | Lec+Tu | W | |
| *Systems Theory and Numerical Mathematics* | | Lec+Tu | W | |
| *Numerical Mathematics practical* | | Lec+PR | W+P | |
| *Project* | | PR | Pj | |
| **201400433 Discrete Structures and Efficient Algorithms** | 15 | | | - |
| *Components: Discrete Structures & Algorithms* | | Lec+Tu | W | |
| *Algebra & Finite Automata* | | Lec+Tu | W | |
| *Research project: Similarity* | | PR | Pj | |
| **201400434 Modelling and Analysis of Stochastic Processes for Math** | 15 | | | - |
| *Components: Stochastic Models* | | Lec+Tu | W | |
| *Stochastic Models Project* | | PR | Pj | |
| *Markov Chains* | | Lec+Tu | W | |
| *Stochastic Simulation Project* | | PR | Pj+P | |
| *Multidisciplinary Project* | | PR | Pj | |
| **Entire academic year** | 60 | | | |

[3] Section 1 explains the abbreviations used in the columns 'teaching method' and 'form of assessment'. Numbers in the column 'sequence requirements' refer to the text following the table.

**Table 3[4]: the third academic year for cohorts starting in 2013 or later**

| | *Study load in EC* | *Teaching method* | *assessment* | *Sequence requirements* |
|---|---|---|---|---|
| **Minor profile** | 30 | | | 1 |
| **201500379 Bachelor's assignment prep** | 15 | | | 2 |
| *Components:* | | | | |
| *Reflection on Mathematical Research I* | | Lec | O | |
| Two of the following four components must be included in the student's curriculum. | | | | |
| *Graph theory* | | Lec+Tu | W | |
| *Optimization* | | Lec+Tu | W | |
| *Random Signals and Filtering* | | Lec | W | |
| *Theory of PDE* | | Lec+Tu | W | |
| **201500380 Bachelor's assignment** | 15 | | | 2 |
| Complex Function Theory | | Lec+Tu | W | |
| Reflection on Mathematical Research II | | Lec | O | |
| Bachelor's thesis | | PR | P+Ps | |
| **Entire academic year** | 60 | | | |

[4] Section 1 explains the abbreviations used in the columns 'teaching method' and 'form of assessment'. Numbers in the column 'sequence requirements' refer to the text following the table.

With reference to sequence requirement 1 (see table above): students may only participate in this study unit once they have earned at least 75 EC.

With reference to sequence requirement 2 (see table above): students may only participate in this study unit once they have passed the first eight modules of the Applied Mathematics programme (see Article 3.2, paragraph 2j).

**Table 4[5]: the first academic year for cohorts starting prior to 1 September 2013.**

**EXAMINATIONS ARE NO LONGER ADMINISTERED FOR THESE SUBJECTS**

| | *Study load in EC* | *Form of assessment* | *Sequence requirements* |
|---|---|---|---|
| **201100103 Calculus** | 5 | W+P | - |
| **201100104 Vector Calculus** | 4 | W+P | - |
| **201100100 Linear Structures I** | 5 | W | - |
| **201100101 Linear Structures II** | 5 | W | - |
| **191521611 Discrete Mathematics I** | 4 | W | - |
| **191521631 Discrete Mathematics II** | 4 | W | - |
| **191530370 Probability** | 5 | W | - |
| **201100102 Analysis I** | 5 | W | - |
| **191560123 Ordinary Differential Equations** | 4 | W | - |
| **191580751 Deterministic Models in the OR** | 4 | W | - |
| **191521501 Mathematical Modelling I** | 5 | Pj+O | - |
| **191540160 Algorithms and Programming I** | 2 | P | - |
| **194113000 Great minds in the history of science** | 3 | W or O | - |
| ***Elective:*** | 5 | | - |
| ***191403021 Dynamics*** | | W | |
| ***191580612 Introduction to Mathematical Economics*** | | W+P | |
| **Entire academic year** | 60 | | |

[5] Section 1 explains the abbreviations used in the columns 'teaching method' and 'form of assessment'. Numbers in the column 'sequence requirements' refer to the text following the table. Study units shown in *italics* are electives.

**Table 5[6]: the second academic year for cohorts starting prior to 1 September 2013.**

**EXAMINATIONS ARE NO LONGER ADMINISTERED FOR THESE SUBJECTS**

| | *Study load in EC* | *Teaching method* | *Form of assessment* | *Sequence requirements* |
|---|---|---|---|---|
| **201100109 Signals and Transformations** | 5 | Lec +Tu+PR | W | |
| **191515603 Intr. to investment theory** | 5 | Lec+Tu | W | |
| **191530382 Mathematical Statistics** | 5 | Lec+Tu | W | |
| **191530651 Markov Chains** | 5 | COL | W | |
| **191540270 Numerical Math. and Modelling** | 5 | Lec+Tu+PR | W+P | |
| **191505001 Presenting a mathematical topic** | 2 | Ps | Pr | |
| **191540170 Algorithms and Programming II** | 3 | COL + PR | P | |
| **191560561 Intro to mathematical systems theory** | 5 | Lec+Tu+PR | W+P | |
| **191505271 Mathematical Modelling II** | 5 | Lec+PR | Pj+O | |
| **191521400 Analysis II** | 5 | Lec+Tu | W | |
| **191511410 Algebra and security** | 5 | Lec+Tu | W | |
| ***Elective:*** | 5 | | | |
| ***191403033 Dyn. Modelling and Simulation*** | | Lec+PR | W+P | |
| ***191530881 Stochastic models in OM*** | | Lec+Tu | W | |
| ***Elective:*** | 5 | | | |
| ***191403051 Electricity and Magnetism*** | | Lec+Tu | W | |
| ***192111801 Basic models in computer science*** | | Lec+Tu+PR | W+P | |
| **Entire academic year** | 60 | | | |

[6] Section 1 explains the abbreviations used in the columns 'teaching method' and 'form of assessment'. Numbers in the column 'sequence requirements' refer to the text following the table. Study units shown in *italics* are electives.

**Table 6[7]: the third academic year for cohorts starting prior to 1 September 2013.**

| | *Study load in EC* | *Teaching method* | *Form of assessment* | *Sequence requirements* |
|---|---|---|---|---|
| **191530821 Stochastic Simulation Project** | 5 | Lec | P+Or | |
| ***Elective:*** | 5 | | | |
| ***191561620 Optimal control*** | | Lec | W | |
| ***201200135 Random Signals and Filtering*** | | Lec | W | |
| ***Elective:*** | 5 | | | |
| ***191520751 Graph Theory*** | | Lec+Tu | W | |
| ***191550105 Theory of Partial Differential Equations*** | | Lec+Tu | W | |
| **191530440 Regression and ANOVA** | 5 | Lec+PR | W+P | |
| **191520252 Complex Function Theory** | 5 | Lec+Tu | W | |
| **191580251 Mathematical Programming** | 5 | Lec+Tu+PR | W or Or | |
| **191599220 Bachelor's assignment** | 10 | | Pj+O | 1 |
| ***Minor*** | 20 | | | 2 |
| **Entire academic year** | 60 | | | |

1. A student may only participate in this study unit once he has earned his first-year certificate and at least 60 EC from the second and third years of the Bachelor's curriculum, excluding the minor. Furthermore, he must have completed the subjects listed as prerequisites for the relevant assignments, and he must have passed Mathematical Modelling II.
2. At a specific date, to be announced in advance, the student must have earned at least 80 EC. The credit total will include the results of examinations from the fourth quarter (or directly subsequent to the fourth quarter), whereas results of examinations sat during the summer break will not be included. The Examination Board may grant dispensation from the 80-credit requirement in individual cases.

[7] Section 1 explains the abbreviations used in the columns 'teaching method' and 'form of assessment'. Numbers in the column 'sequence requirements' refer to the text following the table. Study units shown in *italics* are electives.

## b. The content of the specialisations offered by the programme

The programme offers a single specialisation. The content of this specialisation is listed under a.

## c. The final attainment targets of the programme

The programme covers four fields of competence:

1. domain expertise;
2. research and modelling skills;
3. professional skills;
4. academic reflection.

These fields of competence are specified further in ten final attainment levels:

1. The graduate has thorough knowledge of mathematical theories in the areas of algebra, analysis, statistics, stochastics, and discrete mathematics, and an understanding of the application of these theories in technology, health care and business administration (associated with domain expertise).
2. The graduate can deal with abstraction, is capable of formal reasoning and can construct mathematical proofs (associated with domain expertise).
3. The graduate can use various research methods to answer research questions (associated with research and modelling skills).
4. The graduate can design and analyse mathematical models for problems of a multidisciplinary nature and assess their usefulness in practical situations (associated with research and modelling skills).
5. The graduate is proficient in using a computer to address the increasing size and complexity of mathematical problems. Computer algebra, numerical methods and simulations are key applications in this regard (associated with research and modelling skills).
6. The graduate is a skilled library user who is adept at making the most of the library's resources, including advanced search methods in modern library networks (associated with research and modelling skills and professional skills).
7. The graduate is proficient at giving oral and written reports, and is able to work effectively in a team. The graduate is capable of continually developing collaborative skills (associated with professional skills).
8. The graduate has insight into the position of the field of applied mathematics in society and has acquired a basic understanding of the philosophy of science (associated with academic reflection).
9. The graduate is aware of the opportunities for further specialisation in a Master's programme or for finding gainful employment (associated with academic reflection).
10. The graduate is interculturally competent.

## d. Structure of practicals

Practicals are not subject to any specific provisions with regard to their structure.

## e. Study load of the programme and of each of the study units in the programme

The study load of the study units is indicated under a.

## f. Specific rules regarding Binding Recommendation (BR)

Students pursuing a double degree in Applied Physics and Applied Mathematics are subject to an additional BR provision: the BR may involve removal from the Applied Mathematics programme if the student fails to earn 15 or more EC from the study units associated with the double degree programme. See Table 7 of Part 2 of this Annex for the specific study units.

Students pursuing a double degree in Technical Computer Science and Applied Mathematics are subject to an additional BR provision: the BR may involve removal from the Applied Physics programme if the student fails to earn 15 or more EC from the study units associated with the double degree programme. See Table 8 of Part 2 of this Annex for the specific study units.

## g. Study load of the Master's programme

Not applicable

## h. The sequence of examinations

The sequence of examinations with relation to academic prerequisites is indicated under a.

## i. Programme format

The programme is offered on a full-time basis.

## j. Sequence and periods for examinations and degree audits

The schedules indicate the tests that make up an examination. Degree audits are not restricted to specific periods.

## l. Teaching method and assessment and examination formats

The teaching method for the various study units is indicated under a. The following abbreviations are used:

Lec Lecture
Tu Tutorial
PR Practical

The examination format for the study units is indicated under a. The following abbreviations are used:

W written examination,
Or oral examination,
O one or more assignments: the student submits work (assignments, reports, essays, other documents) and the examiner assesses it without the student being present.
P practical assignment: the student creates and submits a product that can be activated and subsequently assessed on behaviour and/or function and/or usability (e.g. a working program or a functioning prototype),
Pj project: the student participates in a number of group activities. The student will be assessed both on his individual contribution to the activities and the group's products (report, presentation, program),
Ps presentation: the student gives a presentation to the examiner and a group of interested people, generally fellow students.

These codes indicate the nature of assessment, without prescribing any rules for assessment.

## s. Admission standards for examinations and practicals

The admission standards are listed under a.

**t.** Required participation in a practical exercise as a component of an examination

The ‘form of assessment’ column in the tables under (a) shows whether participation is required in a practical exercise as a component of an examination.

# PART 2 SPECIFIC CHARACTERISTICS OF THE PROGRAMME

## a. Language of tuition

English is the language of tuition. The examinations are administered in English.

## b. Educational prerequisites

The following additional provisions apply with regard to the educational prerequisites in Article 2.1 of the general section of these Teaching and Examination Regulations. Students with a first-year certificate from a technology programme at a university of applied sciences may be admitted to the Bachelor's programme in Applied Mathematics if they satisfy the following conditions:

a. Colloqium doctum examinations for both Mathematics B and English
b. take part in an Applied Mathematics matching activity. The programme's recommendation following the matching activity is binding.

## c. Registration of results

- Exemptions for tests are indicated with the code 'VR'. They are assigned a numerical value of 6 for weighting purposes. Exemptions for modules are also indicated with the code 'VR', but they are not assigned a numerical value.
- The student thus has the option of requesting an exemption with the consequence that the exemption be assigned a value of 6 for weighting purposes, or the student may decide to take the test and possibly earn a higher mark.
- The results of complete (V) and incomplete (NVD) have no numerical values.
- The highest mark achieved counts. This also applies to tests.

## d. Pass/Fail regulation

Students who meet the following requirements will pass the Bachelor's final degree audit for the Applied Mathematics programme:

a. The student has received an assessment for all study units of the Bachelor's final degree audit;
b. The student's marks are 6 or higher for all study units;

In all other cases, the student will not pass the final degree audit.

## e. Cum Laude (with distinction)

A student may pass the Bachelor's final degree audit with distinction (cum laude). As a guideline for determining whether to award a degree with distinction, all of the following conditions should be met:

a. The student passes the Bachelor's final degree audit within four years of initial enrolment (performance requirement);
b. The student's average mark is 8.0 or higher (non-numeric assessments not included). This is a weighted average based on the relative number of EC per study unit.
c. No more than one study unit is a mark of 6.
d. The final Bachelor's assignment receives a mark of 8 or higher.

In exceptional cases and at the student's request, the Examination Board may award the distinction of cum laude if the student has met all requirements with the exception of the performance requirement, due to extenuating circumstances. These circumstances may

involve delays recognised and provided for by the institution. It should be noted that the distinction of cum laude is never awarded automatically.

## f. Period of validity of exam results

- The following applies to modules 1, 2, 3, 6, 7, 8, 11 and 12:

  Test results are only valid in the academic year in which they are earned.
- The following applies to Module 4:

  The result of a project retains its validity in the subsequent academic year.

  If only one of the module's test results is a fail, but at least a 4, then the other passing results will retain their validity in the subsequent academic year.
- The following applies to Module 5:

  If only the Analysis II test result is a fail, but at least a 4, then the other passing results will retain their validity in the subsequent academic year.

  If only the Statistics or Project test result is a fail, but at least a 4, then the test results for Analysis II and Presentation Skills will retain their validity in the subsequent academic year.

## g. BSA rules

- The programme uses the Osiris BSA module in its entirety.
- The BSA recommendations are issued based on the results of the modules. At the conclusion of module 1, the recommendation may be positive, negative or neutral.

- There are two types of official recommendations: an interim recommendation and a final recommendation.
- These official recommendations are issued by the programme.
- The letters containing the BSA recommendations are based on a document known as the 'romp-OER' and these decisions.
- The letters containing the BSA recommendations are sent by digitally.
- A digital signature is automatically appended to the BSA recommendation letters.

## h. Compensation scheme

The Compensation scheme applies to a number of clusters as defined in this regulation. These clusters may be confined to individual modules, but they may also contain courses from multiple modules.

Cluster I: Linear Structures I from module 1 (201300056), Linear Structures II and Analysis I from Module 2 (201300057)

Cluster II: Module 3 (201300182)
Cluster III: Module 5 (201400218)

Cluster IV: Module 6 (201400222)

Cluster V: Module 7 (201400433)

Cluster VI: Module 8 (201400434)

In each cluster, a student must:

- Achieve a weighted average mark of at least 5.5;

- Have no more than one mark lower than 5.5;
- Have no marks lower than 4.5;
- Achieve a weighted average mark of at least 5.5 for both modules in the case of compensation in cluster I;
- Meet the condition that the weighted average mark of Analysis I and Analysis II is at least 5.5 and the weighted average mark of Probability and Statistics is at least a 5.5 in the case of compensation in cluster III.

If the Compensation scheme is applied to a module, the final mark for that module will be the weighted average of the components calculated according to the formula used if all components have been passed with a mark of at least 5.5.
The Compensation scheme may be applied once in the first academic year of the Bachelor's programme.
The Compensation scheme may be applied once in the second academic year of the Bachelor's programme.
The Compensation scheme may only be invoked for modules in which all components are completed in the course of a single academic year.

## i. Study units available to students as electives

Table 3 shows the electives available to students who joined the programme on or after 1 September 2013.
Tables 4, 5 and 6 show the electives available to students who joined the programme prior to 1 September 2013. Exams are no longer held for the electives in Tables 4, 5 and 6.
Students complete the Minor profile in Table 3 of section a. by selecting courses in accordance with the institution's rules for the Minor profile, and with the approval of the Examination Board if necessary.

## j. Minor profile

Students may choose from among the minors offered by the University of Twente, or they may compose their own proposal and submit it to the Examination Board for approval. The proposal for the minor must meet the following conditions:

- The minor's academic level must be assured (to be assessed by the Examination Board).
- The minor's components are to be cohesive.

## k. Secondary school teaching certificate

Students who pass the 30-EC 'Learning to Teach' minor will receive, alongside a Bachelor's degree in Applied Mathematics, a mathematics teaching qualification for the initial years of senior general secondary education (HAVO), pre-university education (VWO) and the theoretical learning pathway of pre-vocational secondary education (VMBO), in the Netherlands.

## l. Bachelor's assignment confidentiality

1. Reports of Bachelor's assignments are public documents except in the cases listed in 2.
2. The Programme Board may deem a report to be confidential for a specific period based on a detailed request:

a. The first supervisor must submit a request to the Programme Board prior to the start of the final assignment.

b. The confidential report must be accessible/available to the committee responsible for assessing the Bachelor's assignment, the Programme Board, and representatives of bodies that have a statutory duty of overseeing the quality of the assessment or the programme as a whole.

c. The parties mentioned above are required to respect confidentiality with regard to the report.

## **m.** Double degree programmes

The programme offers two double degrees: Applied Mathematics combined with Applied Physics, and Applied Mathematics combined with Technical Computer Science.

A tailored curriculum applies to students pursuing a double degree in Applied Physics and Applied Mathematics, as detailed in Table 7 below.

A tailored curriculum applies to students pursuing a double degree in Technical Computer Science and Applied Mathematics, as detailed in Table 8 below. The table lists the components of the study units. In each quarter, the components listed under Applied Mathematics form a cohesive study unit, as do the components under Technical Computer Science.

**Table 7: Applied Physics/Applied Mathematics double degree programme**

| | | | |
|---|---|---|---|
| **First academic year** | (80 ECEC) | | |
| **1st Quarter** (21 EC) | **APPLIED MATHEMATICS** | | **TN (201400264)** |
| | *Linear Structures I (201300312) (6 ECEC)*<br>*Math A and ß1 (4 ECEC)* | | *Dynamics & Relativity (6 EC)*<br>*Experimentation 1 (2.5 EC)*<br>*Project (2.5 EC)* |
| **2nd Quarter** (20 EC) | **APPLIED MATHEMATICS (201300057)** | | **TN** |
| | *Mathematics β2 (3 EC)*<br>*Linear Structures II (3 EC)*<br>*Analysis (3 EC)*<br>*Linear Optimization (2 EC)*<br>*Proof Lab (4 EC)* | | *Thermodynamics (201300205) (4.5 EC)*<br>*Programming (0.5 EC)* |
| **3rd Quarter** (20 EC) | **APPLIED MATHEMATICS (201300182)** | | **TN** |
| | *Signals and Transformations (5 EC)*<br>*Probability Theory (5 EC)*<br>*Intro. math. mod. (1 EC)*<br>*Project (5 EC)* | | *Quantum Matter (201400635) (4 EC)* |
| **4th Quarter** (19 EC) | **APPLIED MATHEMATICS** | | **TN (201300164)** |
| | *Vector calculus (5 EC)* | | *Electromagnetism (5 EC)*<br>*Project (5 EC)*<br>*Instrumentation (201400647) (4 EC)* |

| | | | |
|---|---|---|---|
| **Second academic year** | **(78.5 EC)** | | |
| **5th Quarter** (21.5 EC) | **APPLIED MATHEMATICS** | | **TN** |
| | *Statistics (201400357) (5 EC)*<br>*Analysis II (201400358) (5 EC)* | | *Modelling (201500180) (4 EC)*<br>*Systems Analysis (201500182) (4.5 EC)*<br>*SMS Project (201500183) (3 EC)* |
| **6th Quarter** (17 EC) | **APPLIED MATHEMATICS** | | **TN (201500155)** |
| | *Presentation Skills (201400360) (2 EC)* | | *Quantum Mechanics (6 EC)*<br>*Optics (7 EC)*<br>*Hilbert spaces (2 EC)* |

| | | | |
|---|---|---|---|
| **7th Quarter** (21 EC) | **APPLIED MATHEMATICS** | | **TN (201500156)** |
| | *Discrete Math. and Algebra (201400483) (6 EC)* | | *Statistical Physics (6 EC)*<br>*Solid State Physics (7 EC)*<br>*PDV (2 EC)* |
| **8th Quarter** (19 EC) | **APPLIED MATHEMATICS** | | **TN (201500157)** |
| | *Markov Chains (201500520) (4 EC)* | | *Electrodynamics (6 EC)*<br>*Physics of Fluids (7 EC)*<br>*Num Meth for PDV (2 EC)* |

**Third academic year** **(65 EC)**

| | | | |
|---|---|---|---|
| **9th Quarter** (15 EC) | **Minor profile** | | |
| | http://www.utwente.nl/onderwijs/keuzeruimte/minor/ | | |
| **10th Quarter** (15 EC) | **APPLIED MATHEMATICS (201400222)** | | **TN** |
| | *Differential Equations (4 EC)*<br>*Systems Theory (4 EC)*<br>*Numerical Mathematics (4 EC)*<br>*Project (3 EC)* | | |
| **11th Quarter** (15-20 EC) | **APPLIED MATHEMATICS** | | **TN** |
| | electives (5 EC each)<br>*Graph theory (191520751)*<br>*Theory of PDE (191550105)*<br>*Random Signals and Filtering (201200135)*<br>*Mathematical Optimization (201500372)* | *Reflection on Research in Mathematics and Physics*<br>*Bachelor's assignment research proposal* | electives (5 EC each)<br>*Heat and Mass Transfer*<br>*Physical Materials Science*<br>*Technical Optics* |
| **12th Quarter** (15-20 EC) | **APPLIED MATHEMATICS** | | **TN** |
| | *Complex Function Theory (201500405) (3 EC)* | *Bachelor's thesis* | |

**Table 8: TECHNICAL COMPUTER SCIENCE/APPLIED MATHEMATICS double degree programme**

| | | |
|---|---|---|
| First academic year | (81 EC) | |
| 1st Quarter (21 EC) | APPLIED MATHEMATICS | Technical Computer Science (201300070) |
| | Mathematics A and B1 (4 EC) | Pearls of computer science (8 EC) |
| | Linear Structures I (201300312) (6 EC) | Technical Computer Science Project (3 EC) |
| 2nd Quarter (21 EC) | APPLIED MATHEMATICS | Technical Computer Science |
| | Mathematics B2 (3 EC) | Programming Theory |
| | Linear Structures II (3 EC) | Programming Project |
| | Analysis (3 EC) | (8 EC) |
| | Proof lab (4 EC) | |
| 3rd Quarter (20 EC) | APPLIED MATHEMATICS | Technical Computer Science |
| | Signals and Transformations (5 EC) | Network Systems (12 EC) |
| | Probability (part 1) (3 EC) | |
| 4th Quarter (19 EC) | APPLIED MATHEMATICS | Technical Computer Science |
| | Vector calculus (5 EC) | Data and Information (12 EC) |
| | Probability (part 2) (2 EC) | |
| Second academic year | | |
| 5th Quarter (20 EC) | APPLIED MATHEMATICS | Technical Computer Science |
| | Statistics (5 EC) | Computer Systems (15 EC) |
| 6th Quarter (20 EC) | APPLIED MATHEMATICS | Technical Computer Science |
| | Differential Equations (4 EC) | Intelligent Interaction |
| | Systems theory (4 EC) | Design (12 EC) |
| 7th Quarter (21 EC) | APPLIED MATHEMATICS | Technical Computer Science |
| | *Discrete Struct & Algorithms* | |
| | *Algebra & Finite Automata* | |
| | *Research project: Similarity* | |
| | *Module 3 Project (5 EC) plus Intro to Math Modelling (1 EC)* | |

| **8th Quarter** (15 EC) | **APPLIED MATHEMATICS** | | Technical Computer Science |
|---|---|---|---|
| | *Stochastic Models*<br>*Stochastic Models Project*<br>*Markov Chains*<br>*Stochastic Simulation Project*<br>*Multidisciplinary Project* | | |

**Third academic year**

| **9th Quarter** (10 EC) | **APPLIED MATHEMATICS** | | Technical Computer Science |
|---|---|---|---|
| | *Analysis II*<br>*Project*<br>*Presentation Skills* | | |
| **10th Quarter** (15 EC) | **Minor profile** | | |
| | http://www.utwente.nl/en/education/electives/minor | | |
| **11th quarter** (15-20 EC) | **APPLIED MATHEMATICS** | | Technical Computer Science |
| | one of the following subjects<br>*Graph theory*<br>*Theory of PDE*<br>*Random Signals and Filtering*<br>*Optimisation* | *Reflection on Mathematical Research* | *Design assignment* |
| **12th quarter** (15-20 EC) | **APPLIED MATHEMATICS** | | Technical Computer Science |
| | *Complex Function Theory*<br>*Reflection* | *Bachelor's assignment / Bachelor's thesis* | |

# PART 3 TRANSITIONAL ARRANGEMENTS

1. Transitional arrangements apply to the curricula of students in cohorts from 2009 and earlier.
   **Reason:** The Applied Mathematics programme changed one of the third-year electives as of the 2012-2013 academic year. Students who started on the programme at an earlier date are entitled to apply results earned previously towards the EC required for a degree.
   **Period of validity** These transitional arrangements remain in force until 1 September 2017.
   **The arrangements:** A student who started on the programme prior to 1 September 2010 and who passed the Signals and System subject (191571080) may include this subject in his Bachelor's curriculum, and will be subsequently exempted from choosing between the Optimal Control (191561620) and Random Signals and Filtering (201200135) subjects.

2. Applied Mathematics Transitional arrangements due to the Twente Education Model (TOM) for students in the old curriculum
   **Bachelor's assignment**

   Starting in the 2015-2016 academic year, the Bachelor's assignment is an individual assignment combined with reflection on mathematical research. The entire Bachelor's assignment is worth 17 EC. Students in the 2012 cohort or earlier may submit a substantiated request to the Examination Board if they wish to deviate from the current structure involving an assignment combined with reflection on mathematical research.
   **Minor**
   Students in the 2012 cohort or earlier are allowed to take a minor of between 15 and 30 EC.
   **Discontinued subjects**

   Students enrolled in the old version of the programme and who still need to complete subjects for which exams are no longer offered must contact the Study Advisor immediately. Equivalent subjects will be offered, with due observance for the learning goals, for incomplete subjects for which exams are no longer offered. These equivalent subjects will consist of study units from the new curriculum, and will be submitted to the Examination Board for approval.

3. Transitional arrangements that apply to the Bachelor's degree audit for students in cohorts from 2012 and earlier.
   **The arrangements:** Students who started on the programme in September 2012 or earlier will pass the Bachelor's degree audit once they have satisfied the following conditions:

   • All study units from the first year of the Bachelor's curriculum have been completed with a mark of 5 or higher and no more than one 5 appears on the first-year Bachelor's transcript;
   • All study units from the second and third years of the Bachelor's curriculum have been completed with a mark of 5 or higher and no more than one 5 appears on the second- and third-year Bachelor's transcript;
   • the average of all marks is equal to or greater than 6.
   • the mark for the Bachelor's assignment is 6 or higher.