Faculty of
Science & Technology

UNIVERSITY OF TWENTE.

# *Programme-specific appendix to the programme part of the students' charter, including the education and examination regulations of the Applied Physics (AP) Master's Programme*

# *(art. 7.13 and 7.59 WHW)*

## Contents



**Preamble**

1. The rules in this appendix apply to the full-time master's programme Applied Physics (No. 60436).
2. Together with the general section, this programme-specific appendix forms the programme section of the student charter including the Education and Examination Regulations for the master's programme Applied Physics of the faculty Science and Technology at the University of Twente.
3. The programme is subject to the legislation of the Dutch Higher Education and Research Act (WHW).


Reference: TNW19288/esk/vdh
Date: 19 July 2019

## Article 1 Programme Objective

1. Designing of physics instruments for research and industrial applications.
2. Performing fundamental research with a view to applications.

The programme aims to provide knowledge, skills and insight in the field of Applied Physics that enables graduates to enter into an independent profession or to qualify for further training as a teacher, scientific researcher or technical designer.

## Article 2 Intended Learning Outcomes

The required level of physics during and after the programme is determined nationally and internationally. In view of the objectives of the programme, education is aimed at acquiring:

- Thorough knowledge of the basic theories in the domain of physics and mathematics;
- Thorough knowledge of one or more sub-areas in the physics domain;
- Knowledge of physics technology, including skills for designing and using measurement instruments and experimental techniques;
- Orientation into the application areas of Applied Physics;
- Insight in the interrelation between sciences and the relationship between sciences, and the resulting responsibilities;
- Skills such as being able to independently acquire knowledge; being able to creatively and systematically contribute to resolving problems in the field; being able to cooperate with colleagues and non-colleagues; and communicational, social and organizational skills.

## Article 3 Admission Board

1. An admission board is appointed by the dean of the faculty of Science and Technology for the admission to the master's programme of students who are not directly admissible in accordance with Article 4, section 2a.
2. The executive board has delegated the authority to accept or reject students (S&C/387.191/lk) to the board mentioned under section 1.
3. The admission board is chaired by the programme director. In case of foreign students or students with a qualification in higher professional education respectively the internalization coordinator or the higher professional coordinator is a member of the admission board.
   If the chair deems it necessary, the secretary of the board of examiners and/or the study adviser can join the admission board.

## Article 4 Admission to the Programme

1. The programme has two intake moments: 1 September and 1 February.
2. Direct admission to the programme is granted to students who possess:
   a. a degree in one of the bachelor's programmes in Applied Physics or Physics at a Dutch university, or
   b. a proof of admission to the programme, issued by the admission board.
3. During assessment of the application for admission to the master's programme, the admission board can demand that some subjects must be passed before the proof of admission to the master's programme can be issued.
4. When a proof of admission to the master's programme is issued, the admission board may decide to grant exemption for particular parts of the programme, with exception of the final master's assignment.
5. A proof of admission to the master's programme issued by the admission board may impose conditions on the specific content of the student's master's programme.
6. The decisions of the admission board in sections 4 and 5 of this article require the approval of the board of examiners.
7. The following applies for students with a qualification in higher professional education (University of Applied Sciences; hbo) in Applied Physics or Electrical Engineering:
   a. They can be admitted to a transfer programme of 30 EC,
   b. The transfer programme is compiled by the programme board. More detailed information can be found on the website of the programme (www.utwente.nl/ap).
   c. Students must complete the transfer programme within a period of 1 year and will be given two opportunities to take the exam. The courses must be completed with a minimum grade of 5.5.
   d. Instead of the transfer programme mentioned above, students with a qualification in higher professional education can also attend a transfer minor of 30 EC (Kies-Op-Maat) during their higher professional education. The transfer minor is identical to the transfer programme.
   e. After completion of the transfer programme, the candidates can be admitted to the master's programme. The master's programme for students with a qualification in higher professional education in Applied Physics or Electrical Engineering is defined in Article 6 of this programme-specific appendix.
8. Students in possession of a bachelor's degree in Applied Mathematics, Advanced Technology, Biomedical Technology or Electrical Engineering of a Dutch University may be admitted to the regular master's programme if their bachelor's programme meets the conditions specified in Article 8a of this programme-specific appendix.
9. Students in possession of a bachelor's degree of the University College Twente or Chemical Science and Engineering of a Dutch university may be admitted to the regular master's programme if their bachelor's programme meets the conditions specified in Article 8b of this programme-specific appendix.
10. Students with a previous education at a foreign institution must demonstrably have sufficient language skills in spoken and written English. A requirement for their admittance to the programme may be a sufficient score in a recognized test. This means a total score of 6.5 or higher for the IELTS test, or a score of 90 or higher for the Internet-based TOEFL test[1]. Students in possession of a bachelor's degree from a country where English is the main language in higher education[2] are exempt from this requirement.

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1 IELTS: International English Language Testing System; TOEFL: Testing of English as a Foreign Language; see the UT website on admittance to the master's programme's: https://www.utwente.nl/en/education/master/admission-requirements/international-degree

2 The list of countries can be found at https://www.utwente.nl/en/education/master/admission-requirements/international-degree/countries

## Article 5 General Master's Programme

The master's programme consists of;
- 4 compulsory courses (20 EC) in the first year;
- 20 EC specialization courses;[3]
- 10 EC elective courses at master level within the technical or physics domain;
- 10 EC free electives;[4]
- An external internship of 20 or 30 EC; If the 30 EC internship is chosen then the elective courses are reduced by 10 EC;
- A final master's assignment of 40 EC.

The Applied Physics curriculum contains a list of recommended (elective) courses for each Applied Physics chair. Other recommended courses are also listed in the table below.

Capita Selecta courses can be used for activities done for a chair that are not part of regular courses. The contents, method and scope are determined by the chair. For this purpose, a registration form must be completed, on which the course code, name, amount of EC's as well as the subject, material used, the assessment and the title are recorded.

A student who has already passed one or more compulsory courses of the master's programme during the bachelor's degree or has passed courses that can be approved as an elective course in the master's programme, can be exempted for these courses. The student does not receive a reduction in the total amount of EC's that has to be passed in the master's programme.

The study programme requires the approval by the graduation professor and the programme's board of examiners. The graduation professor approves if the study programme is compiled in accordance with the conditions of the master's programme.

The final master's assignment is assessed with two grades: One for physics aspects, and one for general aspects. The physics aspects include theoretical insight, experimental skills, problem-solving capability and originality, and scientific relevance in terms of physics and/or technology. The general aspects comprise independence, commitment, ability to collaborate, creativity, level of the presentation and the final report, and accessibility and usability of the results.

**Compulsory courses AP**

| Quartile | Code | Name | EC |
|---|---|---|---|
| 1A | 191411291 | Applied Quantum Mechanics (Kelly) | 5.0 |
| 1B | 201900080 | Mathematical and Numerical Physics (Kooij) | 5.0 |
| 2A | 191470241 | Heat and Mass Transfer (Krug) | 5.0 |
| 2B | 201800422 | Small Signals and Detection (Marpaung) | 5.0 |
| - | - | Internship 20 EC (193599010) / 30 EC (201700185) (Folkers) | 20/30 |
| - | 201800344 | Master's Assignment: Physical Aspects (Kooij) | 20 |
| - | 201800345 | Master's Assignment: General Aspects (Kooij) | 20 |

[3] The specialization courses depend on the chair in which the final assignment is done. See Curriculum AP.

[4] The free electives should be filled with specialization courses of other chairs from the Applied Physics programme, courses of other master's programmes (see websites of the other programmes) and/or extra Applied Physics courses shown in the table on the next page.

**Fluid/Soft Matter Courses**

| Quarter | Code | Course | EC | SC[a)] | RC[a)] |
|---|---|---|---|---|---|
| 1A | 193570010 | Advanced Fluid Mechanics (Huisman) | 5.0 | PoF | EMS, PCF |
| | 201300135 | Soft and Biological Matter (Lemay) | 5.0 | BE, NBP, PCF | CCP, PoF |
| | 201700187 | Soft and Biological Techniques (Duits)[b)] | 5.0 | | BE, NBP, PCF |
| | 201800083 | Advanced Colloids and Interfaces (Wood) | 5.0 | | BE, PCF |
| 1B | 193580010 | Turbulence (Lohse) | 5.0 | PoF | |
| | 193572010 | Physics of Bubbles (Versluis) | 2.5 | PoF | |
| 2A | 193580020 | Experimental Techniques in PoF (Gomez) | 5.0 | PoF | EMS |
| | 193400121 | Nano-Fluidics (Siretanu) | 5.0 | BE, PCF | PoF |
| | 201400194 | Granular Matter (v.d. Meer) | 5.0 | PoF | |
| | 193542070 | Medical Acoustics (Versluis) | 5.0 | BMPI, PoF | |
| 2B | 201400195 | Fluids and Elasticity (Snoeijer) | 2.5 | PoF | |
| | 193565000 | Capillarity Phenomena (Mugele) | 5.0 | PoF, PCF | BE |
| - | 201300137 | Ions and Devices (Lemay) | 5.0 | BE | |

**Materials Courses**

| Quarter | Code | Course | EC | SC[a)] | RC[a)] |
|---|---|---|---|---|---|
| 1A | 193530010 | Nanophysics (Zandvliet) | 5.0 | PIN, ICE, QTM, CMS, XUV | EMS, IMS |
| | 193530000 | Intr. to Superconductivity (Dhalle) | 5.0 | ICE, QTM, EMS | |
| | 193700010 | AMM - Characterization (Huijser) | 5.0 | IMS | NBP |
| 1B | 193510040 | Theoretical Solid State Physics (Kelly) | 5.0 | ICE, QTM, CMS, CCP | COPS, EMS, XUV, PIN, IMS |
| | 201100214 | Applications of Superconductivity (Dhalle) | 5.0 | EMS | |
| | 193400141 | Nano-Electronics (vd Wiel) | 5.0 | | OS |
| 2A | 193550020 | Surfaces and Thin Layers (Wormeester) | 5.0 | PIN, XUV, IMS | EMS |
| | 193510030 | Electronic Structure Theory 2 (Brocks)[c)] | 5.0 | CMS | |
| | 193700040 | AMM-Inorganic Materials Science (Koster) | 5.0 | IMS, XUV | |
| 2B | 201500167 | MTCMP (van Houselt) | 5.0 | PIN | |
| | 201100146 | Cryogenic Science and Techn. (ter Brake) | 5.0 | EMS | CCP, CMS, |
| | 200900066 | Intr. to the Physics of Corr. El. (Golubov) | 5.0 | | ICE, QTM, PIN |
| - | 193510020 | Electronic Structure Theory 1 (Kelly)[c)] | 5.0 | CMS | |

**Optics Courses**

| Quarter | Code | Course | EC | SC[a)] | RC[a)] |
|---|---|---|---|---|---|
| 1A | 201300139 | Laser Physics (Boller) | 5.0 | LPNO, OS | COPS, NBP |
| | 193515000 | Quantum Optics (Pinkse) | 5.0 | COPS | LPNO |
| | 193400131 | Nano-Optics (Garcia-Blanco) | 5.0 | | NBP, OS |
| | 193640020 | Biophysical Techn. and Mol. Imaging (Otto) | 5.0 | NBP | BMPI |
| 1B | 193520030 | Nonlinear Optics (Boller) | 5.0 | LPNO, OS | COPS |
| 2A | 201300141 | Wave Optics (v.d. Slot) | 5.0 | LPNO, OS, COPS, BMPI | XUV, NBP |
| | 201100074 | Nanophotonics (Vos) | 5.0 | COPS | |
| | 191210880 | Integrated Optics (Garcia Blanco) | 5.0 | OS | |
| | 193400111 | Bionanotechnology (Bennink) | 5.0 | | NBP |
| 2B | 201400196 | Quantum Emitters (Vos) | 5.0 | | COPS |
| | 193500000 | Biomedical Optics (Vellekoop) | 5.0 | BMPI | |
| - | 201100075 | Nanophotonic Experiments (Vos/Pinkse)[d)] | 5.0 | COPS | |
| | 193520040 | Exp. Laser Physics and Nonlinear Optics (Bastiaens for LPNO / Offerhaus for OS)[d)] | 5.0 | LPNO | COPS, NBP, OS |

**General Physics Courses**

| Quarter | Code | Course | EC | SC[a)] | RC[a)] |
|---|---|---|---|---|---|
| 1A | 201800166 | Classical Mechanics (Filippi)[e)] | 4 | | |
| | 193640060 | Radiation Expertise (v. Dijk)[d)] | | | |
| 1B | 193530040 | Intro.to High Energy Physics (v. Eijk) | 5 | | EMS |
| | 193570050 | Advanced Quantum Mechanics (Brocks) | 5 | CCP | COPS, CMS, XUV, LPNO |
| 2A | | | | | |
| 2B | 193570040 | Theory of General Relativity (van Damme) | | | CCP |
| - | | | | | |

**Applied Physics/Engineering Courses**

| Quarter | Code | Course | EC | SC[a)] | RC[a)] |
|---|---|---|---|---|---|
| 1A | 201800338 | Engineering Solid Mechanics (Schilder)[e)] | 4 | | |
| | 201600180 | Molecular Struct. and Spectr. (Huijser)[f)] | 2.5 | | OS |
| 1B | 191210730 | Technology (Kovalgin) | 5 | | XUV |
| | 201700026 | Electr.Power Eng. and Sys. Integr. (Dhalle) | 5 | | EMS |
| 2A | 191407051 | Intr. to Instr. Computers (Veugelers) | 2.5/5 | | |
| | 201400037 | Linear Solid Mechanics (Ellenbroek) | 5 | | EMS |
| | 201700025 | Solar Energy (Reinders) | 5 | | |
| | 193530050 | Magn. Methods for (Neuro) Imag. (Haken) | 5 | | |
| 2B | 201800114 | Imaging Techn. in Radiology (Simonis) | 5 | | BMPI |
| | 201700024 | Wind Energy (Venner) | 5 | | |
| - | 191211000 | Advanced semiconductor devices (Salm)[d)] | 5 | | |
| | 200900068 | CS Advanced X-ray Scattering | - | | IMS |

**Mathematics Courses**

| Quarter | Code | Course | EC | SC[a)] | RC[a)] |
|---|---|---|---|---|---|
| 1A | 191560430 | Nonlinear Dynamics (Meijer) | 5 | | PoF |
| 1B | 191551150 | Numerical Techniques for PDE | 5 | | |
| 2A | 201700034 | Introduction to PDE (Akkaya) | 5 | | COPS |
| 2B | 201800131 | Numerical Methods for Engineers | 5 | | PoF |
| | 191154731 | Computational Fluid Dynamics | 5 | | PoF |
| | 201500405 | Theory of Complex Functions (Jeurnink) | 3 | | COPS, CMS, LPNO, OS, PoF |

**Computer/Programming Courses**

| Quarter | Code | Course | EC | SC[a)] | RC[a)] |
|---|---|---|---|---|---|
| 1A | 201600070 | Basic Machine Learning | 5 | | |
| | 191158510 | Programming in Engineering | 3 | | |
| | 201400174 | Data Science | 5 | | |
| 1B | 201600071 | Advanced Machine Learning | 5 | | |
| | 201800177 | Deep Learning | 5 | | |
| | 192140200 | Algorithms, Datastructures and Complexity | 5 | | |
| | 201400174 | Data Science | 5 | | |
| | 201200044 | Managing Big Data | 5 | | |
| | 191158500 | Advanced Programming in Engineering | 5 | | |
| 2A | 201700176 | Computational Physics 1 (Filippi) | 2.5 | CCP | |
| | 201700177 | Computational Physics 2 (Filippi)[g)] | 2.5 | CCP | |
| | 191210910 | Image Processing and Computer Vision | 5 | | BMPI |
| | 201800482 | Machine Learning | 3/5 | | |
| | 201400174 | Data Science | 5 | | |
| 2B | 201100254 | Adv. Comp. Vision and Pattern Recognition | 5 | | BMPI |
| | 201500583 | Machine Learning for Medical Applications | 1.5 | | BMPI |

a) SC is Specialization Courses, RC is Recommended Courses, see also Curriculum AP.
b) Soft and Biological Techniques can only be done in combination with Soft and Biological Matter. It is open for master students when the maximum of student places for the minor participants is not reached. Please contact the teaching staff.
c) Electronic Structure Theory 1 and 2 can be done independently. Electronic Structure Theory 1 is not required for Electronic Structure Theory 2.
d) Students who want to participate in this course, please contact the teaching staff.
e) This course is part of the Bachelor TN module M05 Signals, Models and Systems, course code 201800159. To participate in this course/module part you have to register for the whole module. The schedule can be found on the module code.
f) Part of AT Module 09 Condensed Matter Physics (201800130).
g) Computational Physics 1 is prior knowledge for Computational Physics 2.

## Article 6 Programme for Students with a Qualification in Higher Professional Education

The standard programme for students with a qualification in higher professional education (University of Applied Sciences; hbo) in Physics or Electrical Engineering is summarized in the table below.

| First and second year (M1 and M2) | | |
|---|---|---|
| Course code | Name | EC |
| | | |
| General physics courses (31 EC) | | |
| 201500184 | Quantum Mechanics | 6 |
| 201500192 | Statistical Physics | 6 |
| 201500194 | Electrodynamics | 6 |
| 201500196 | Physics of Fluids | 7 |
| 201500185 | Hilbert Space | 2 |
| 201500193 | Partial Differential Equations | 2 |
| 201500195 | Numeric Methods for PDE | 2 |
| | | |
| 4 compulsory courses (20 EC) in the first year;<br>20 EC specialization courses;[5]<br>10 EC elective courses at master level in the technical or physics domain;[6] | | |
| | | |
| Compulsory courses (40 EC) | | |
| 201800345 | Master's Assignment: General Aspects | 20 |
| 201800344 | Master's Assignment: Physical Aspects | 20 |
| | | |
| Total master | | 121 |

[5] The specialization courses depend on the chair in which the graduation assignment is done. See curriculum AP.

[6] The free electives should be filled with specialization courses of other chairs from the Applied Physics programme, courses of other master's programmes (see websites of the other programmes) and/or extra Applied Physics courses shown in the table mentioned in article 5.

## Article 7 Standard Programme for Double Master's Programme

A double master's programme is a combination of two separate master's programmes, which the student follows in parallel and involves a combined final master's project and a combined internship.

The standard programme combining two masters 1 and 2 is summarized in the table below.

| | |
|---|---|
| Compulsory courses Master 1[7] | 30-45 EC |
| Compulsory courses Master 2[7] | 30-45 EC |
| Combined Internship | 30 EC |
| Combined Master Assignment | 60 EC |
| Elective courses[8,9] | 0-30 EC |
| Total | 180 EC |

To comply with requirements of the other master's programme, deviations from this programme may be required.

## Article 7a Master's Programme with First-Degree Teaching Qualification

A student can obtain a first-degree teaching qualification in Physics by enrolling in the Dutch taught master's programme Science Education and Communication' (SEC). There are also several options to combine a master's programme Applied Physics with a first-degree teaching qualification in Physics:

1. For students without a second-degree teaching qualification in Physics, the double master's programme comprises a total of 180 EC, a combination of the 120 EC M-AP programmme and a 60 EC educational part of the first-degree teaching programme. The internship (20 EC) and free electives (10 EC) of the M-AP programme can be used for the educational part resulting in a 150 EC double master's programme.
2. For students with a second-degree teaching qualification in Physics, the double master's programme comprises a total of 150 EC, a combination of the 120 EC M-AP programme and a 30 EC educational part (due to a 30EC exemption) of the first-degree teaching programme. A student can also use the internship (20 EC) and free electives (10 EC) in the M-AP programme for the 30 EC educational part.

In both cases, the student receives a master's degree in Applied Physics, including a first-degree teaching qualification. The content of the various programmes can be found on the website of the M-AP programme www.utwente.nl/ap/

## Article 8a Admission Requirements for BSc AM/AT/BMT/EE students

Students with a bachelor's degree in Applied Mathematics, Advanced Technology, Biomedical Technology or Electrical Engineering must complete the following courses to be admitted to the master's programme Applied Physics:

201800130 Condensed Matter Physics for AT, Q 1A or
    201600067 Condensed Matter Physics for TN (Dutch), Q 2A (15 EC)[10]
201500155 Waves, Interference and Probability, Q 1B
    - Quantum Mechanics (6 EC)
    - Hilbert Space (2 EC)[10]
    - Optics (7 EC)[11]
201600068 Continuum Dynamics, Q 2B
    - Electrodynamics (6 EC)[12]
    - Numerical Methods for PDE (2 EC)[10]
    - Physics of Fluids (7 EC)[11]

Depending on the specialization in the M-AP programme, other courses can be added in consultation with the study adviser.

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7 Courses that are part of both compulsory master's programmes are placed in the most appropriate programme.

8 A maximum of 15 EC premaster courses can be part of the double programme

9 The electives can be used to do separate internships

10 For AM and UCT students the Math part (PDE, Hilbert Space, or Num.Meth.PDE) is already covered by their own programme and can be skipped

11 Depending on the specialization in the master the student can choose one of the two courses Optics or Physics of Fluids.

12 Electrodynamics is not necessary for admission to the M-AP programme. When this course is not a part of the bachelor programme, it will be a compulsory course of the M-AP programme, with the exception of EE students.

### Article 8b Admission Requirements for BSc CSE/UCT Students

Students with a bachelor's degree in Chemical Science and Technology or from the University College Twente must complete the following courses to be admitted to the master's programme Applied Physics:

201700164 Electromagnetism and Measurements, Q 2A
- Electromagnetism (5 EC)
- Instrumentation (4 EC)[13]
- Analytical Programming (1 EC)

201800130 Condensed Matter Physics for AT, Q 1A or
201600067 Condensed Matter Physics for TN (Dutch), Q 2A
- Statistical Physics (5/6 EC)
- Solid State Physics (5/7 EC)[13]

201500155 Waves, Interference and Probability, Q 1B
- Quantum Mechanics (6 EC)
- Hilbert Space (2 EC)[10]

201600068 Continuum Dynamics, Q 2B
- Electrodynamics (6 EC)[12]
- Numerical Methods for PDE (2 EC)[10]

Depending on the specialization in the M-AP programme, courses can be added in consultation with the study adviser (for example Dynamics, Models, Physics of Fluids or Optics).

### Article 9 Transition Arrangement

1. In the event of a change to the programmes included in Articles 5, 6, 7 and 7a in this appendix, or of a change to one of the other articles included in the general part or in this programme-specific appendix, a transition arrangement will be defined and announced by the programme director.
2. Article 8.4 of the general part states the conditions to be met by a transition arrangement.
3. The transition arrangement will be published on the website of the master's programme Applied Physics.

### Article 10 Safety

Working in a laboratory is subject to safety requirements. Students must acquaint themselves with these rules[14] and abide by them.

### Article 11 Sequence of Study Units

1. Prior to starting a programme unit, the student must meet the knowledge requirements of the programme unit.
2. The student can only start the final master's assignment when he/she has successfully completed at least 50 EC of the M1 master's programme.
3. Prior to the final examination, the student must have successfully completed all other programme units.
4. The programme board is authorized, after consultation with the board of examiners, to grant exemption from the conditions in sections 1 to 3 of this article if strict application of those terms would result in an unreasonable delay in study progress. The student can submit a request to this end to the programme board.

### Article 12 Flexible Degree Programme

Contrary to the provisions in Articles 5, 6, 7 and 7a of this appendix the student can request permission of the board of examiners to compose a flexible degree programme in the sense of Art. 7.3h of the law. The board of examiners assesses whether the programme fits within the domain of the programme, is coherent and whether the level is sufficient in terms of the programme intended learning outcomes.

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[13] UCT students can only participate in one of the lab courses after they have completed the Basic Lab course of AT.

[14] See the rules on occupational health and safety and the environment, at http://www.utwente.nl/tnw/intra/diensten/amh/ and the information of the Practicum Group of the Faculty of Science and Technology, at http://www.utwente.nl/tnw/slt/.

## Article 13 Student Counselling

1. The task of the study adviser is to individually advise students on their studies, and to inform the programme director on the study progress of the students.
2. Once a graduation chair has been selected, the daily supervisor, in consultation with the professor, will monitor the student's progress and maintains contact with the programme board and/or the study adviser.

## Article 14 Quality Assurance and Evaluation

1. The programme board is responsible for the evaluation of the programme.
2. The execution of the evaluation of the education of the master's programme is dedicated to the coordinator quality assurance of the Science & Technology faculty and the programme director. They are supported by students from the Educational Quality Committee Applied Physics. The coordinator quality assurance is the chair of the Educational Quality Committee Applied Physics.
3. The following evaluation tools are used:
   a. Panel meetings with students;
   b. Web surveys of the master's courses[15];
   c. Web survey of the final master's assignment.
4. The results of the internal quality assurance activities will be published in the following manner:
   a. Summary of the web surveys and response of the lecturers regarding the evaluation will be sent to the programme committee;
   b. Summary of web surveys and the response of the lecturer will be placed in the Canvas course 'TN/AP Quality assurance and evaluation' which is accessible for all students and lecturers of the programme.

   To evaluate the curriculum and the master's programme in its entirety the following internal and external evaluations are used:
   c. The exit survey about the entire master's programme;
   d. The National Student Survey (NSE)[16];
   e. The National Alumni Survey (NAE)[17].

   The programme board will respond to the evaluations and provide a plan for improvement. The evaluation including the plan for improvement will be presented to the programme committee.
5. The programme board draws up an annual improvement plan, based on internal and external evaluations and new insights.
   a. The improvement plan will be discussed with the programme committee;
   b. The improvement plan will be included in the faculty's annual report;
   c. The faculty's annual report will be discussed with the executive board by the dean and the portfolio holder education

## Article 15 Effectuation and Changes

These regulations will come into effect on 1 September 2019 and replace the regulations dated 31 August 2018.

**Established by the board of the Faculty Science & Technology, after advice from the Faculty Council and the Programme Committee Applied Physics and after consent of the Programme Committee Applied Physics with articles 2, 5, 6, 7, 7a, 10 and 14.**

Enschede, 19 July 2019.

[15] Master courses are not evaluated each year; starting point is a frequency of at least once every three years.

[16] The NSE is taken annually.

[17] The NAE is taken every two years.