Teaching and Examination Regulations (TER) 2023-2024

(see Article 7.13, WHW)

Faculty of Electrical Engineering, Mathematics and Computer Science

MASTER'S DEGREE PROGRAMMES

Applied Mathematics

Computer and Embedded Systems Engineering

Computer Science

Electrical Engineering

Sustainable Energy Technology

Most important changes to Teaching and Examination Regulations faculty EEMCS 2023 - 2024

- **Article 3 Subsection 3 [admission master programme]**
  This provision will be dropped. It concerned an addendum in connection with the COVID-19 pandemic.
- **Article 13 Subsection 1**
  Adjustment of the Article in connection with problems with the registration deadline for examinations taken in Q5. The registration deadline was changed in the past from 6 to 14 calendar days. That change resulted in students failing to meet the registration deadline for Q5 or registering en masse for exams they passed in the regular exam opportunity. The registration deadline for Q5 is reset to 6 calendar days.
- **Article 16 Subsection added**

  RRobE - Article 15, sub 5 was originally stated in the model TER. This subsection has been moved back from the RRobE to the faculty TER 2023-2024. In this way, the model TER and the faculty TER are in synch again.
- **Article 17A Subsection 1**

  Adjustment of "examinations" in second sentence to "assessment" to emphasize forms of testing such as projects and practicals also fall under this Article. Furthermore, the possibility of offering an alternative option for forms of assessment such as projects and practicals (which in practice cannot always be offered twice per academic year) has been emphasized. It is also indicated that -within the limits of proportionality- additional requirements can be set for this. This change to Article 17A has significant consequences for the implementation of education. Additional rules are added to Article 5 of the Implementation Regulations.
- **Article 19 Subsection 5**

  The Article has been modified by adding an unambiguous deadline, in relation to the application deadline.

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Part 1 – General

Article 1 – Areas to which the regulations apply

1. These regulations apply to teaching and examinations of the Master's degree programmes in Applied Mathematics, Computer and Embedded Systems Engineering, Computer Science, Electrical Engineering, and Sustainable Energy Technology hereafter referred to as the programmes.
2. These programmes are provided under the responsibility of the Faculty of Electrical Engineering, Mathematics and Computer Science at Delft University of Technology (EEMCS), hereafter referred to as the faculty.
3. The programme is governed by the Implementation Regulations (Appendix I), which are part of these Teaching and Examination Regulations.
4. The Teaching and Examination Regulations and the Implementation Regulations are laid down by the dean.

Article 2 – Definitions of terms used

The terms used in these regulations should be interpreted as meaning the same as in the Higher Education and Scientific Research Act, insofar as they are defined in that Act.

1. The following terms are to be defined as follows:

1	Act	the Higher Education and Scientific Research Act (in Dutch, the WHW), in the Dutch Bulletin of Acts, Orders and Decrees, number 593 and as amended since
2	programme	the master's degree programme as denoted in Article 7.3a section 1, of the Act
3	student	anyone enrolled at Delft University of Technology as a student or extraneous student for the purpose of benefiting from education and/or for the purpose of sitting the examinations and undergoing the final examination which form part of the programme
4	cohort	the group of students who have registered for a degree programme for the first time in a given academic year
5	quarter	half of a semester, period of 10 weeks as stipulated in the academic calendar
6	examination period	the period where exams and resits will take place, as stipulated in the academic calendar. Only resits will take place in week 5.3. See also MyTimetable.tudelft.nl
7	course	a teaching unit within the programme as intended in Article 7.3, section 2 and 3 of the Act, with which an examination is associated
8	practical exercise	course or component of a course aimed at the acquisition of particular skills. The following can be understood as practical exercises: ▪ writing a thesis or paper;

		▪ conducting a project or experimental design; ▪ completing a design or research assignment; ▪ completing a project; ▪ conducting a literature review; ▪ completing an internship; ▪ participating in fieldwork or an excursion; ▪ conducting tests and experiments; ▪ participating in other educational activities aimed at enabling participants to attain certain skills.
9	examination	investigation of the student's knowledge, insight and skills with regard to a subject, along with the assessment of that investigation by at least one examiner, appointed for that purpose by the Board of Examiners. An examination can also consist of interim examinations.
10	interim examination	an assessment of the knowledge, insight and skills of a student in relation to a component within a course, as well as the marking of that assessment by at least one examiner, appointed for that purpose by the Board of Examiners
11	degree audit	An assessment by the Board of Examiners whereby it is determined, in accordance with Section 7.10 of the Act, whether all examinations in the subjects of the degree programme have been successfully completed
12	Board of Examiners	the programme's Board of Examiners, which has been installed in accordance with Article 7.12 of the Act
13	examiner	the individual who, in line with Article 7.12, section 3 of the Act, has been appointed to set the examinations
14	Implementation Regulations	the Implementation Regulations which form part of these Teaching and Examination Regulations
15	credit/EC	a credit awarded in line with the European Credit Transfer System (ECTS); one credit denotes a study load of 28 hours
16	working day	Monday to Friday with the exception of recognised national public holidays and the collective closure days
17	Study Guide	the digital guide to the programme containing specific information pertaining to the various subjects (studiegids.tudelft.nl)
18	institute	Delft University of Technology
19	electronic learning environment	an electronic system designed for the exchange of teaching information e.g. Brightspace
20	student registry system	an electronic system designed for the registration of study progress, e.g., Osiris; including MyTUDelft

21	disability	all conditions which are (at least for the specified period) chronic or lasting in nature and which form a structural limitation for the student in receiving education and/or sitting examinations or taking part in practical exercises
22	IEP	Individual Exam Programme
23	academic year	the period from 1 September till 31 August of the following calendar year
24	bridging programme	a deficiency programme aimed at moving up to a master's degree programme, while enrolled in a bachelor's degree programme, but without obtaining a bachelor's degree (as stipulated in Article 7.30e or 7.57 of the Act)
25	programme duration	the duration starting from the enrolment of the student till the last examination
26	track	major, as stipulated in Article 7.13, Section 2, Subsection b of the Act

2. The other concepts in these regulations are used in the sense in which they appear in the Act.
3. Where these Regulations refer to examinations, they also refer to interim examinations, with the exception of the first two sentences of Article 19 Subsection 2, and Article 22A Subsection 1.
4. A written or oral examination may also be taken digitally and/or online. In these regulations the term examination is also taken to mean a digital and/or online examination, unless stated otherwise in these regulations.
5. In these regulations, unforeseen circumstances and/or measures are defined as large-scale force majeure situations such as a (new) pandemic. This allows TU Delft to anticipate quickly and efficiently to adapt education and facilities when necessary.

Article 3 – Admission to the master's degree programmes (Art. 7.30b WHW)

BoS advisory powers

The admission to the master's degree programmes is stated in the Implementation Regulations (Appendix I) of the specific programme.

- Admission to the Master’s degree programme Applied Mathematics (Appendix I. Article 7)
- Admission to the Master’s degree programme Computer and Embedded Systems Engineering (Appendix I. Article 12)
- Admission to the Master’s degree programme Computer Science (Appendix I. Article 17)
- Admission to the Master’s degree programme Electrical Engineering (Appendix I. Article 22)
- Admission to the Master’s degree programme Sustainable Energy Technology (Appendix I. Article 27)

Article 4 – University entrance examination

Not applicable for MSc.

Article 5 – Goal and final attainment levels of the master's degree programmes (art. 7.13 Section 2, Subsection c WHW)

BoS right of approval

The goal and final attainment levels of the master's degree programmes are stated in the Implementation Regulations of the specific programme.

- Goal and final attainment levels of the Master's degree programme Applied Mathematics (Appendix I. Article 9)
- Goal and final attainment levels of the Master's degree programme Computer and Embedded Systems Engineering (Appendix I. Article 14)
- Goal and final attainment levels of the Master's degree programme Computer Science (Appendix I. Article 19)
- Goal and final attainment levels of the Master's degree programme Electrical Engineering (Appendix I. Article 24)
- Goal and final attainment levels of the Master's degree programme Sustainable Energy Technology (Appendix I. Article 29)

Article 6 – Track (Art. 7.13 Section 2, b WHW)

BoS right of approval

The tracks of the master's degree programmes are stated in the Implementation Regulations of the specific programme.

- Tracks of the Master's degree programme Computer Science (Appendix I. Article 21A and 21B)
- Tracks of the Master's degree programme Electrical Engineering (Appendix I. Article 26A)
- Tracks of the Master's degree programme Sustainable Energy Technology (Appendix I. Article 30A)

Part 2 – Composition of the degree programme and the degree audit

Article 7A – Composition of the degree programme and the degree audit (Art. 7.13 Section 2, Subsections a, e, g and x of the WHW)

BoS advisory powers (a, x); right of approval (e, g) – FSC right of approval (x)

1. The composition of the degree programme and the relevant transitional regulations are laid down in the Implementation Regulations (appendix I).
2. The programme includes the master's degree audit, with a study load of 120 credits. (Subsection e, g)
3. Following approval from the two Boards of Examiners concerned, a student may take an individual double degree programme in which two master's programmes are combined simultaneously to create a

programme of at least 180 credits. Upon completion the student is awarded two master's diplomas. The student must earn at least 60 unique credits for each master's degree programme[1].

4. A course that was part of the bachelor's degree programme that qualified a student for admission to the master's degree programme may not be included in the master's degree programme. If a compulsory component has already been completed in the aforementioned bachelor's degree programme, the Board of Examiners will designate an alternative course. If an elective course of the degree programme has already been completed in the aforementioned bachelor's degree programme, the student will select an alternative elective course. (Subsection a)
5. The master's degree audit is concluded with a final test or assignment. This test or assignment demonstrates that the student possesses and is able to apply the knowledge, insight and skills acquired in the degree programme. (Subsection a)
6. The degree programme is described in the digital Study Guide, along with the subjects, including the study load, number of contact hours and form of examination of each subject, as well as the programming of the examination and the language. (Subsection e, x)
7. The actual design of the education is elaborated in greater detail in the Study Guide. (Subsection x)

Article 7B – Flexible exam programme

1. According to Article 7.3h of the law on Higher Education and Research, students can draw up a flexible exam programme that will lead to an examination. This programme requires approval of the Board of Examiners prior to the start of the flexible exam programme. The programme must consist entirely or primarily of courses that are provided for the benefit of the programme, but may be supplemented with courses that are provided by or for the benefit of other programmes.
2. Prior to the start of the flexible programme, the student must obtain advice from the academic counsellor and the relevant Director of Studies. The academic counsellor gives a recommendation on the study feasibility of the intended flexible exam programme. The Director of Studies gives a recommendation on the content of the intended flexible exam programme.
3. Unlike the IEP referred to in Article 4 of the Implementation Regulations, the intended flexible exam programme and recommendations by the academic counsellor and Director of Studies has to be submitted by the student for approval to the Board of Examiners prior to the start of the intended flexible exam programme.

Article 8 – Form of the programme (Art. 7.13 Section 2, Subsection i WHW)

FSC right of approval, BoS advisory powers

All programmes are offered exclusively on a full-time basis.

Article 9 – Language (Art. 7.2 WHW)

FSC right of approval, BoS advisory powers

The education is in English, and the examinations are administered in English.

[1] See the Rules and Regulations of the board of examiners - Article 28 for the specific requirements of the individual Double Master's Degree programme https://www.tudelft.nl/en/student/eemcs-student-portal/education/rules-regulations

Part 3 – Honours Programme and other annotations

Article 10 – Honours Programme (art.7.9b WHW)

FSC right of approval, BoS advisory powers

1. Students who have shown an excellent performance during the first semester:
   - at least 30EC,
   - no fails or resits, and
   - a weighted average mark of 7.5 out of ten or higher

   may apply to the Delft University of Technology Honours programme for outstanding master's students.
2. Based on the above criteria and their Honours Programme proposal (see website for template) with their project description, students can be selected and admitted to the Honours Programme by the director of studies or an Honours Programme coordinator or Honours Programme committee established by the director of studies.
3. Students can only apply for the extra Honours Programme before March 1st during the first year of their master programme.
4. The Honours Programme will comprise at least 20 credits:
   a. 5 credits must be completed in the Delft University of Technology-wide component of the Honours Programme. Course descriptions can be found on the faculty website.
   b. At least 15 credits must be completed in the faculty component of the Honours Programme, the composition of which (including its content and options) is described on the faculty website.
5. The Board of Examiners will be responsible for assessing whether all the requirements of the Honours Programme have been met.
6. Any student who has successfully completed the Honours Programme and their master's programme will be awarded a certificate signed by the chair of the Board of Examiners and the Rector Magnificus.

Article 11 – (Compulsory) participation in the programme (Art. 7.13 Section 2, Subsection t WHW)

FSC right of approval, BoS advisory powers

1. All students are expected to participate actively in the programme for which they are registered.
2. If necessary, there will be an obligation to participate in practical exercises, for the purpose of admission to the related examination. The Board of Examiners may grant an exemption from this obligation, with or without imposing a substitute requirement.
3. Any additional obligations are described for each course in the digital Study Guide.

Article 12 – Evaluation of the study programme (Art. 7.13 Section 2, Subsection a1 WHW)

BoS right of approval

1. The Director of Studies is responsible and ensures the implementation of the evaluation of the education.
2. The manner in which the education in the programme is evaluated is documented in the faculty's Quality Assurance Manual, which is submitted to the Faculty Student Council and the Board of Studies.
3. The Director of Studies informs the Board of Studies concerning the outcomes of the evaluation, the intended adjustments based on these outcomes and the effects of the actual adjustments.

Part 4 – Registering and withdrawing

Article 13 – Registration for written examinations

FSC right of approval; BoS advisory powers

1. Registration to participate in a written examination, including a written examination that is taken online remotely from the university, is compulsory and is done by entering the requested data into Osiris no later than 14 calendar days before the examination. Contrary to this, a registration period of 6 calendar days applies to resits in the summer resit period. In both cases, the student will receive an exam ticket by email as confirmation.
2. Students may submit a request to register for an examination after the deadline mentioned in Subsection 1 has passed but no later than 6 calendar days before the examination in question in Osiris. As a result, students will be placed on a waiting list. The request will be honoured providing that places are available in the room or rooms where the examination is scheduled to take place. The student will receive an exam ticket by email as confirmation.
3. In the case of circumstances beyond a student's control, whereby the student is unable to register for the examination, the Board of Examiners can still permit the student to participate in the examination.
4. A student who has not registered for an examination and is therefore not included on the list of participants, may report to the invigilator on the day of the examination from 15 minutes before until the start of the examination. In so far that there are seats available, they will be admitted to the examination room 30 minutes after the start of the examination in the order they reported to the invigilator. The lack of 30 minutes examination time cannot be compensated. Students who have thus gained access to the exam will be added to the list of participants. The student takes the examination subject to the reservation that it will be investigated whether the student is entitled to participate in the examination.
5. In case the investigation leads to the conclusion that the student was not entitled to participate in the examination, then this examination will be invalidated, will not be evaluated and does not lead to a result. The student can submit a substantiated request to the Board of Examiners to have the examination that is considered to be invalid, to be declared valid and to have it assessed. The Board of Examiners will only agree to the request in exceptional circumstances.
6. Subsections 2 and 4 of this Article do not apply to a written examination administered online remotely from the university.

7. If unforeseen circumstances or measures make it necessary to change the form or manner of taking the examination, the Board of Examiners may determine a different registration period in favour of the student.

Article 14 – Registration assessment other than written examinations

FSC right of approval; BoS advisory powers

1. Registration for participation in an assessment other than a written examination is possible up to 14 calendar days before the examination, unless otherwise stated in the Study Guide, and will take place in the manner indicated in the Study Guide for the relevant examination. If, due to unforeseen circumstances or measures the form or manner of taking the examination changes, what is stated in the Study Guide will apply unless the dean decides to deviate from the manner or term for registration prescribed in the Study Guide.
2. In special cases the Board of Examiners may deviate from the period of registration referred to in Subsection 1, however only in favour of the student.
3. Students who have not registered on time will not be allowed to participate in the examination. In exceptional circumstances the Board of Examiners may allow the student to participate in the examination.
4. If a student participates in an examination for which the student was not properly registered, the Board of Examiners can declare the results of the examination to be invalid.

Article 15 – Withdrawal written examination

FSC right of approval; BoS advisory powers

1. Students can withdraw from an examination via the student registry system up to 3 calendar days before the examination takes place.
2. Any student who has withdrawn from an examination should re-register on a subsequent occasion, in accordance with the provisions of Article 13. As long as the registration period for an exam is open, a student may re-register for an exam

Part 5 – Examinations

Article 16 – The form of examination and method of assessment in general (Art. 7.13 Section 2, Subsections h and l WHW)

FSC right of approval, BoS advisory powers

1. Examinations are set in the manner described in the Implementation Regulations (appendix I) and in the digital Study Guide, i.e. orally, in writing or in any other way. Practical skills are tested during the hours allocated for practical training. In case of unforeseen circumstances or measures, the Board of Examiners may decide to deviate from the prescribed form. If the form of the examination is changed, students will be informed no later than 3 days before the examination. If an examination is held by means of online proctoring, this takes place in accordance with the TU Delft Regulation on online proctored examinations.

2. The form of the examinations is specified in the Study Guide before the start of the academic year.
3. In the Implementation Regulations (appendix I) and/or in the digital Study Guide, it is described at what times and the number of times the examinations can be taken, as well as their sequence, without prejudice to the provisions in these regulations regarding written and oral examinations
4. A student may participate in an examination for a subject no more than twice in one academic year, with the understanding that registration for an examination without timely withdrawal, as described in Article 15 - Subsection 1, counts as participation.
5. The Board of Examiners may deviate from the provisions of this Article in favour of the student in special cases.
6. Well before a written examination, the examiner will give the students the opportunity to familiarise themselves with representative sample questions and the general criteria by which they will be assessed. The teacher or examiner will provide accompanying guidelines for the way in which the sample questions are answered.

Article 17A – Times and number of examinations (Art. 7.13 Section 2, Subsection j WHW)

FSC right of approval, BoS advisory powers

1. Two opportunities to take written examinations will be offered each academic year. The previous provision applies equally to assessments other than written examinations, unless this cannot be reasonably demanded of the programme. In those cases, a different option will be provided, if at all possible. Participation in this may -within the limits of proportionality- be subject to additional requirements. The times in which the examinations can be taken are:
    a. the first opportunity is immediately after the teaching period for the course to which the examination in question relates,
    b. the second opportunity is at a later point in the same academic year.
2. The frequency of examinations is laid down in the Implementation Regulations (appendix I) and the digital Study Guide. A timetable of all the opportunities to sit written examinations is drawn up on an annual basis and distributed before the start of each semester.
3. If absolutely necessary, changes can be made to this examinations' timetable but only with the approval of the Board of Examiners and if the changes are communicated to students through the official means of communication (the electronic learning environment) at least 4 weeks in advance. In case of force majeure, deviation from this period is allowed, only by decision of the Board of Examiners.
4. If an examination is part of a course not offered by the faculty of EEMCS the relevant stipulations in the Teaching and Examination Regulations of the relevant programme will apply. The Board of Examiners reserves the right to make decisions that deviate from the norm regarding this matter.
5. Notwithstanding the provisions of Subsection 1, there will be at least one chance in a year to sit examinations relating to courses not taught in a given academic year.
6. In exceptional cases, the Board of Examiners may permit more than two opportunities in a year for certain examinations.

Article 17B – Sequence and entry requirements of examinations and practical exercises

FSC right of approval, BoS advisory powers

1. If there is a fixed sequence in which students are required to sit examinations and participate in practical exercises, this will be laid down in the Implementation Regulations (appendix I).
2. If there are entry requirements for a course these are specified in the Study Guide before the start of the teaching period in which this course is offered.

Article 18 – Oral examinations (Art. 7.13 Section 2, Subsection n WHW)

FSC right of approval, BoS advisory powers

1. Only one student at a time will sit an oral examination, unless the Board of Examiners specifies otherwise. In case of group work, the examiner can decide to have more than one student sit the oral examination.
2. Oral examinations and group presentations shall not be public unless the Board of Examiners has decided otherwise.
3. In deviation from Subsection 2 a final presentation[2] is given publicly except in special cases in which the Board of Examiners has decided otherwise, whether or not at the request of the student.
4. An oral examination is preferably conducted by two examiners, and in any case if a student requests it. In case of unforeseen circumstances or measures, the Board of Examiners may determine that the oral examination will be conducted by one examiner. An in-person oral examination with one examiner must have at least an audio recording. An online oral exam with one examiner must have a video recording with audio[3].
5. The student must be able to provide proof of identity prior to an oral examination.

Article 19 – Determining and announcing the results (Art. 7.13 Section 2, Subsection o WHW)

FSC right of approval, BoS advisory powers

1. The examiner determines the result of a written examination as quickly as possible but by no later than 15 working days after the examination. The results of written interim examinations shall be announced no later than five working days before the next written interim examination.
2. The examiner determines the result of the oral examination and publishes the result. This will take place no later than 15 working days after the oral examination, and no later than 5 working days after the last examination of a group that takes the same examination.
3. The examiner ensures that the results are registered and communicated in Osiris (if applicable) within the time frame mentioned under Subsection 2, taking due account of the student's right to privacy.
4. In case of a practical exercise, the examiner is required to determine the result as soon as possible after the last due date on which (the last part of) the practical exercise was to be handed in, but within 15

[2] Final presentations are BSc End project and MSc thesis project.
[3] More information https://www.tudelft.nl/en/privacy-security/privacy/doelgroepen/student

working days at most. The examiner ensures that the results are registered and communicated in Osiris (if applicable) within this time frame, taking due account of the student's right to privacy.

5. Contrary to the previous provisions, results for examinations administered in the last regular examination period shall be determined, registered and published by no later than the Friday following the final week of this examination period. Education and exam periods are indicated in the academic calendar.
6. If the examiner is not able to meet the previously mentioned requirements due to exceptional circumstances, the examiner must inform the Board of Examiners, stating the reasons for the delay and inform the students as soon as possible.
7. Regarding any examinations that are not taken orally, in writing or as a practical exercise, the Board of Examiners shall determine beforehand precisely how and within which period of time the student will be notified of the results.
8. When receiving the result of an examination, the student will be made aware of the right to inspect the results as referred to in Article 20, as well as the opportunity to lodge an appeal with the Examination Appeals Board.

Article 20 – The right to inspect the results (Art. 7.13 Section 2, Subsection p WHW)

FSC right of approval, BoS advisory powers

1. For a period of at least 20 working days after notification of the results of any written examination, the student has the right to request to inspect their assessed work. During the inspection of the assessed work, it is not permitted to copy the underlying examination questions in any way, unless the examiner gives permission. On request students will be supplied with a copy of the assessed work.
2. During the period referred to in Subsection 1, all students who have sat the examination may acquaint themselves with the questions and assignments set in the examination, as well as with the criteria used for marking.
3. The examiner may determine that the right to inspection or perusal referred to in Subsections 1 and 2 will take place at a time and location specified beforehand.
4. If the student can prove that the student is or was unable to be present at the location at the set time due to circumstances beyond their control, then another opportunity will be provided, if possible, within the period stated in Subsection 1. The aforementioned location and time will be announced well in advance.

Article 21 – Discussing the examination results (Art. 7.13 Section 2, Subsection q WHW)

FSC right of approval, BoS advisory powers

1. For a period of 20 working days after the results have been announced, students who have taken a written examination may submit a request to discuss the results with the relevant examiner. This discussion will take place within a reasonable time span and at a place and time determined by the examiner.
2. As soon as possible after the results of an oral examination and practical exercises have been announced, an opportunity is arranged to discuss the results, either at the student's request or at the initiative of the examiner. At this meeting, the reasons behind the marks awarded will be explained.

During the discussion of the assessed work, it is not permitted to record and/or copy the underlying examination questions in any way, unless the examiner gives permission.

3. In cases where a collective discussion is organised by or on the instructions of the examiner, a student may only submit a request, as described in Subsection 1, if the student was present at the collective discussion and if the student provides a good reason for the request or if, due to circumstances beyond their control, the student was unable to attend the collective discussion.
4. The Board of Examiners may permit departures from the provisions of Subsections 2 and 3.

Article 22A – Validity of examinations (Art. 7.13 Section 2, Subsection k, Art. 7.10, Section 4 WHW)

FSC right of approval, BoS advisory powers

1. The result of a final grade[4] is valid for an unlimited period. The dean can restrict the period of validity of a successfully completed examination only if the knowledge or insight that was examined has become outdated or if the skills that were examined have become outdated.
2. In cases involving a limited period of validity based on the first Subsection, the period of validity shall be extended at least by the duration of delay in studies, acknowledged by and based on the TU Delft Profiling Fund Scheme.
3. In individual cases involving special circumstances, the Board of Examiners can extend periods of validity that have been limited based on the first Subsection or further extend periods of validity that have been extended based on the second Subsection.
4. If a course consists of interim examinations, the period of validity of the interim examination for which no credits are assigned shall be restricted to that academic year.

Article 22B – Invalidation of examination or part thereof (art. 7.12 and 7.12b WHW)

FSC right of approval, BoS advisory powers

The Board of Examiners is authorized to invalidate an examination or part thereof, if it has not been reasonably possible to properly assess the knowledge, insight and/or skill of the student on the examination or part thereof.

Part 6 – Exemptions

Article 23 – Exemption from examinations or obligation to participate in a practical exercise (Art. 7.13 Section 2, Subsection r WHW)

FSC right of approval, BoS advisory powers

1. After having obtained recommendations from the relevant examiner, the Board of Examiners may grant exemption from an examination on the grounds of:

[4] Meaning a result or several partial results which has or have been registered in the student registry system in such a way that credits are allocated for the course.

a. an examination involving a unit of study that, in terms of content and study load, was equivalent to a comparable university course in the Netherlands or beyond, or
b. an examination or degree audit completed within the Dutch higher education system or elsewhere which, in terms of content and study load, corresponds with the examination for which exemption is sought, or
c. proof of knowledge and/or skills acquired outside the higher education system.

2. After having obtained recommendations from the relevant examiner, the Board of Examiners may grant exemption from the requirement to participate in a practical exercise with a view to admission to the related examination, possibly subject to alternative requirements.

Part 7 – Degree Audit

Article 24 – Periods and frequency of degree audits (Art. 7.13 Section 2 WHW)

FSC right of approval, BoS advisory powers

1. In principle, the opportunity to take the master's degree audit will be offered once each month. In the monthly meeting of the Board of Examiners, she declares students graduated from the master's programme. The dates set by the Board of Examiners are published before the start of the academic year.
2. All students can apply to take the degree audit as soon as they have fulfilled the conditions of their programme, and have provided the Student Programme Administration office with proof of the programme components they have passed. An additional condition of the programmes is to submit the thesis report to the repository of the Delft University of Technology Library, except for possible parts with an obligation of secrecy towards the originator of the project.

Part 8 – Studying with a support need

Article 25 – Adjustments to the benefit of students with a support need (Art. 7.13 Section 2, Subsection m WHW)

FSC right of approval, BoS advisory powers

1. Students with a support need means students who are held back due to a functional limitation, disability, chronic illness, psychological problems, pregnancy, young parenthood, gender transition, or special family circumstances, for example in relation to informal care. Upon a written and substantiated request to that effect, students with a support need may be eligible for adjustments in teaching and examinations. These adjustments are coordinated to the situations of the students as much as possible, but they may not alter the quality or level of difficulty of a course or the study programme. Facilities to be provided may include modifications to the form or duration of examinations and/or practical exercises to suit individual situations or the provision of practical aids[5].

[5] More information and examples of adjustments to examinations can be found here: https://www.tudelft.nl/en/student/counselling/studying-with-a-disability

2. The request referred to in the preceding Subsection has to be submitted by the student within five weeks after the start of studies or within five weeks after the discovery of the support need.
3. The request referred to in Subsection 1 should be accompanied by a recent medical certificate from a doctor or a psychologist. If there is evidence of dyslexia, the request should be accompanied by a document issued by a recognised dyslexia-testing bureau (i.e. registered with BIG, NIP, or NVO). If possible, this certificate should also estimate the extent to which the support need forms an obstacle to study progress.
4. Requests for the adaptation of teaching facilities will be decided upon by the dean or by the director of studies acting on the dean's behalf. The Board of Examiners will decide on requests for adaptations to examinations or she mandates the academic counsellor on a case-by-case basis.

Part 9 – Study progress checks and reporting

Article 26 – Study support and Monitoring of student progress (Art. 7.13 Section 2, Subsection u WHW)

FSC right of approval, BoS advisory powers

1. The dean is responsible for providing individual study supervision to students registered for the degree programme, partly for their orientation towards potential study options within and outside the degree programme. The dean will also ensure that effective support and supervision is provided to students in making choices related to their studies.
2. The examination and study programme applying to each student is documented in Osiris.
3. The Student Programme Administration is responsible for ensuring that all students are able to review and check their results in the Osiris student-information system.

Article 27 – (Negative) binding recommendation on the continuation of studies

Not applicable.

Part 10 – Contravention, changes and implementation

Article 28 – Contravening the regulations

If the Study Guide and/or any other regulations relating to the study programme and/or the examination programme prove to contravene these Teaching and Examination Regulations and the accompanying Implementation Regulations, precedence will be given to the provisions of these Teaching and Examination Regulations in combination with the Implementation Regulations.

Article 29 – Changes to the regulations

1. Any changes made to these regulations will be made by special resolution of the dean.
2. Amendments that are applicable to the current academic year will be made only if they would not reasonably adversely affect the interest of students.
3. Amendments to these regulations may not lead to disadvantageous changes to any decisions that have been made with regard to individual students.
4. As a result of unforeseen circumstances or measures the dean may decide to deviate from these regulations, including the actual design of the education and any compulsory attendance requirements. This also means that it is possible to deviate from the provisions of the Study Guide.

Article 30 – Transitional regulations

1. If the composition of the exam programme undergoes content changes or if these regulations are amended, the dean will draw up transitional regulations that will be incorporated into the Implementation Regulations (appendix I) Article 32B.
2. Such transitional regulations are required to include:
   a. a provision concerning the exemptions that can be given on the basis of examinations already passed;
   b. a provision specifying the period of validity of the transitional regulations.
3. Students shall follow the degree programme as it applied or applies during the first academic year of their enrolment, unless components of the programme are no longer offered. In such cases, students must transfer according to the applicable transitional regulations. Deviations require the approval of the Board of Examiners. Before submitting a request to this end, the student must have first obtained recommendations from an academic counsellor.
4. If a course is cancelled in a degree programme, four opportunities to sit an examination in this course will be granted after the last classes have been taught: an examination in the last teaching period of the course, a resit in the same academic year, and two resits in the subsequent academic year.
5. If a new exam programme is drawn up for a certain year of study, students that started before that year may change their IEP with the understanding that they include either all compulsory parts of the old programme or all compulsory parts of the new programme. Any change in the IEP needs the approval of the Board of Examiners.
6. Students with an approved IEP may complete this programme, in so far as courses are available. In the case where courses are no longer available, they may be substituted by existing courses according to the relevant course equivalencies as stated in the Implementation Regulations (appendix I) Article 32A and Implementation Regulations (appendix II). However, the total number of EC of the IEP must be at least 120 EC. Any change in the IEP that is not covered by the course equivalencies in Appendix I, Article 32A and Appendix II needs the approval of the Board of Examiners.
7. If it is no longer possible to complete an exam programme, students must submit a new IEP according to the exam programme described in the current Implementation Regulations (appendix I).

Article 31 – Publication of the regulations

1. The dean is responsible for finding a suitable way of publicising these regulations and the relevant Implementation Regulations (appendix I), the transitional regulations defined in the Implementation Regulations, as well as any changes to the regulations.
2. The Teaching and Examination Regulations, together with the accompanying Implementation Regulations, will always be published on the faculty website.

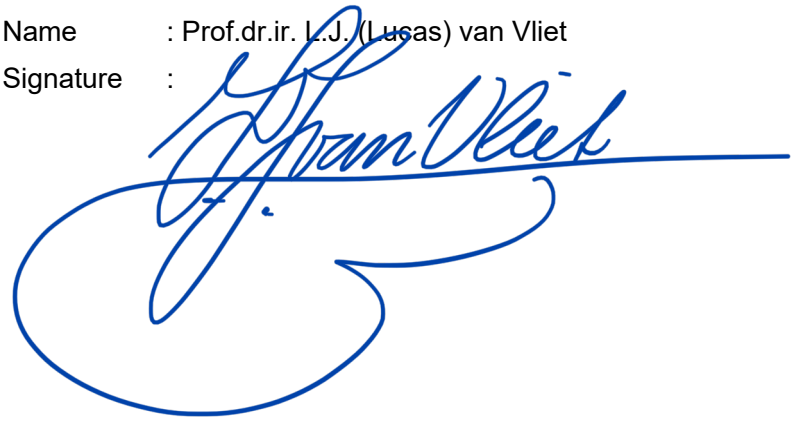
Article 32 – Entry into force

These Regulations and their appendices will come into effect on September 1, 2023.

Issued by the dean of the Faculty in August 2023, after the approval and recommendations of the Faculty Student Council and the Board of Studies for Applied Mathematics, Computer and Embedded Systems Engineering, Computer Science, Electrical Engineering, Sustainable Energy Technology.

Name : Prof.dr.ir. L.J. (Lucas) van Vliet

Signature :



APPENDIX I. IMPLEMENTATION REGULATIONS

Part 1 – General

Article 1 – Study load and duration

Each master's degree programme has a duration of two years (120 credits) and starts annually in September. It is also possible to start the master's degree programme in the second semester, but students are advised that there might be dependencies on first semester courses. This could limit the choice of courses to be followed by students who start the master's programme in the second semester.

Article 2 – Programme structure

1. Each master's degree programme comprises the following components[6]:
    a. Core courses, which provide the basic knowledge required for all students in the master's degree programme. Core courses are prescribed by each master's degree programme.
    b. Courses aimed at providing students with the opportunity to specialise and to prepare for their thesis project. Such courses may be prescribed, chosen from a fixed list or elected freely.
    c. Courses aimed at removing deficiencies, the extent of which to be limited by the study programme.
    d. A thesis project that serves as final assessment of the student (Article 3).
2. Each semester the dean issues lists of all courses offered to the students of the faculty. The lists with these courses are published in the Study Guide.

Article 3 – The thesis project

1. The thesis project is the last study unit of the programme and serves to prove that the student has acquired the academic competencies of a Master of Science. The project involves a research or design task with sufficient academic level. The project may be executed within a research programme at Delft University of Technology, or in a suitable research institute or company. The project must be executed with a systematic approach and should include all phases of a research or design project: problem formulation, analysis, modelling, implementation/construction and validation/evaluation. The student executes the thesis project independently, with guidance of one or more thesis supervisors, at least one of them from the scientific staff of Delft University of Technology.
2. The thesis projects of the programmes are governed by the EEMCS Graduation Policy (MSc). This requires that a student obtains a Declaration of Credits Obtained before embarking on the thesis project. In order to obtain a Declaration of Credits Obtained, at least 60 credits of the master's degree course work as stated in their IEP should be completed.
    a. Every programme at EEMCS has specific requirements and alterations to the graduation framework, these are available at the programme specific Thesis Brightspace pages (see website).
    b. Additional requirements for the Master Computer Science are stated in the Addendum to the EEMCS Graduation Policy.

[6] Nomenclature may differ.

3. With regard to the thesis project, the thesis supervisor may impose additional conditions to be met before starting the thesis project.
4. The thesis project and resultant thesis report should comprise original work carried out by the student as part of the master's programme.
5. Students may present and defend their thesis work only after they have finished all courses as stated in their approved Individual Exam Programme (IEP).

Article 4 – Individual Exam Programme (IEP)

a. Students draw up their IEP according to the programme structure described in Article 2 and the stipulations of the relevant programme, in consultation with the master coordinator and the IEP reviewer appointed by the head of the EEMCS research group where the student plans to perform their thesis project.
b. Students must submit their IEP for approval by the Board of Examiners before the start of the fourth quarter of the first year.
c. If the contents of a compulsory course correspond to a large degree to the course contents of one or more courses followed in a prior exam programme, a student can apply for exemption from the compulsory course. It must be replaced by a specialisation course[7], with at least the same number of credits.
d. If the student has completed a TU Delft MicroMasters (equivalent to 18 credits), the student may be exempted from the courses in the connecting master's programme without the number of credits (depending on the student's IEP 0 to 18) having to be replaced. This is the case for the MicroMasters programme Solar Energy Engineering, which is connected to the programmes Sustainable Energy Technology and Electrical Engineering, track Electrical Power Engineering. The Board of Examiners may ask for an additional proof of competence in order to grant an exemption.

Article 5 – Examination requirements

1. From Rules and Guidelines of the Board of Examiners (art. 7.12 W.H.W.), Delft University of Technology, Faculty of Electrical Engineering, Mathematics and Computer Science the student meets the requirements for the degree audit once the following have been met:
   a. A result has been earned for all subjects: a mark, a pass (v) or an exemption (vr).
   b. None of the marks may be lower than 6.0.
2. The method of assessment will be transparent so that the student can ascertain how the result was reached.
3. In special cases the Board of Examiners may deviate from the provisions of Subsection 1. It will stipulate additional requirements if necessary.
4. The examination requirements for special programmes such as Erasmus Mundus and COSSE are stated with the programme details of the relevant programmes.
5. Part 1 – General, Article 17A, subsection 1, states that all assessment other than written examinations have two opportunities per academic year. For assessment other than written examinations, the two

[7] For the MSc programme Sustainable Energy Technology (SET) an elective course can be chosen (as there is no mention in this programme of specialisation courses).

opportunities consist of a regular examination opportunity and a repair opportunity (no resit) per academic year, unless this cannot be reasonably required of the programme[8].

The conditions for offering a repair opportunity are:

a. An examiner will offer a student a repair opportunity when the obtained result of an assessment other than a written examination leads to a partial grade in the range of 4.0 up to 6,0 (excluding 6.0). This sub concerns the regular examination opportunity.
b. The maximum obtainable result for the repair option is a 6.0.
c. The repair opportunity takes place no later than the quarter following the regular examination opportunity in the same academic year.
d. In case of a pass/fail assessment, the examiner determines the extent to which the fail is equivalent to the grade range defined in subsection 5a.

Article 6 – Completion of bridging programme prior to the degree programme

1. A student who is enrolled in a bachelor's degree programme for a bridging programme with the aim of being admitted to the master's degree programme at TU Delft, must complete this bridging programme within two academic years,
2. In case a student fails to complete the bridging programme within the period specified in Subsection 1 of this Article, their enrolment is terminated. Under exceptional personal circumstances the student can submit a well-founded request for an extension of the course duration for a period of at most twelve months.
3. The Executive Board will set the fee to be charged, as denoted in Article 7.57i of the Act, for the enrolment as student in a bridging programme and for the extension thereof, as denoted in Subsection 2 of this Article.

[8] Practical implementation determines whether a repair opportunity can reasonably be offered. It is not reasonable to ask a programme to offer a repair opportunity for an entire process, but it is reasonable to offer a repair opportunity for a deliverable. For example, in case of a group project where a student did not participate in the project group, then it is not reasonable to ask the examiner to offer a repair opportunity. If it concerns a fail for a deliverable (e.g. the report of the group work) then an examiner can reasonably be expected to offer a repair opportunity.

Part 2A – Applied Mathematics

Article 7 – Admission to the Master's degree programme Applied Mathematics (Art. 7.30b WHW)

1. **Degrees from Dutch higher education institutions**

   Individuals holding one of the following degrees have access to the education of the Master's degree programme in Applied Mathematics on the condition that the stated requirements have been met.

   a. Bachelor's degree in Applied Mathematics (Technische Wiskunde) from Delft University of Technology, Eindhoven University of Technology, University of Twente or University of Groningen;
   b. Bachelor degree in Mathematics (Wiskunde) from a Dutch research university;
   c. A completed bridging programme in Applied Mathematics from TU Delft.

   Students who possess a Dutch bachelor's degree not mentioned above are required to obtain proof of admission to the programme from the dean, who will seek the advice of the admission committee on this matter.

2. **Degrees from foreign higher education institutions**

   Individuals holding a foreign bachelor's degree will be assessed on an individual basis by the admission committee.

   a. The following quantitative admission requirements must be met:
      1) Bachelor's degree in (Applied) Mathematics or equivalent, and
      2) a minimum bachelor's Cumulative Grade Point Average (CGPA), specific requirements are defined per country (see website). If the country is not listed in the overview, the required minimum CGPA is 75%,
      3) Sufficient knowledge (study load) in and good scores for Applied Mathematics key subjects (see below under b), and
      4) English language proficiency, the requirements can be found in Article 33 in the Implementation Regulations (appendix I) Implementation.
   b. The following qualitative admission requirement must be met:

      For the master's degree programme in Applied Mathematics sufficient knowledge of the following key subjects is required:
      1) optimisation;
      2) applied analysis (numerical analysis, PDEs);
      3) abstract analysis (measure theory, metric spaces);
      4) probability and statistics.
   c. In addition, candidates are required to submit a CV and a motivation statement. In case of capacity issues, a cap may be installed on non-EER students.

3. **Admission to the programme 2024-2025**

   Subsection 2 of this Article applies, but additionally:

   a. For EER students with an international BSc degree, a rolling admission applies with an application deadline of April 1st 2024. Enrolment is only possible per September 1st.

b. For non-EER students with an international BSc degree the application deadline is January 15th 2024. There will be a selective admission on the basis of submitted materials. Enrolment is only possible per September 1st.

Details of the application procedure and deadlines are published on the website.

Article 8A – Bridging programmes for research university graduates

1. Students having obtained a bachelor's degree in Electrical Engineering, Applied Physics, Nanobiology, Civil Engineering, Applied Earth Sciences, Mechanical Engineering, Marine Technology or Aerospace Engineering from TU Delft (WO) can gain access to the Master's degree programme in Applied Mathematics via a bridging programme.
   a. The bridging programme for Applied Mathematics for students with the bachelor programmes mentioned in Subsection 1 of this Article contains the following courses:

Course code	Course name	EC
AM1010	Mathematical Structures	6
AM2090	Real Analysis	6
AM2070	Partial Differential Equations	6
AM2080	Introduction to Statistics	6
Specifically for students BSc EE, AP, NB		
AM2020	Optimization	6
Elective for BSc CT, AES, ME, MT, AE (See the list of electives at Subsection 2)		
AM2060	Numerical Methods 1	6

2. Bachelor degree in Econometrics
   a. Students having obtained a bachelor's degree in Econometrics from a Dutch University (WO) can gain access to the master's degree programme via a bridging programme.
   b. The bridging programme for Applied Mathematics for students with a bachelor in Econometrics contains the following courses:

Course code	Course name	EC
AM1010	Mathematical Structures	6
AM2090	Real Analysis	6
AM2060	Numerical Methods 1	6
WI3150TU	Partial Differential Equations A	3
WI3151TU	Partial Differential Equations B	3
AM2040	Complex Function Theory	6
	2nd or 3rd year Elective	6

Electives bridging programme AM		
Course code	**Course name**	**EC**
AM2560	Applied Algebra: Codes	6
AM2510	Decision Theory	6
AM2570	Markov Processes	6
AM2580	Mathematical Models in Biology	6
AM2550	Advanced Statistics	6
AM2520-P	Philosophy of Mathematics	6
AM2520-H	History of Mathematics	6
AM3500	Mathematics Seminar	6
AM3540	Inverse Problems	6
AM3570	Fourier Analysis	6
AM3590	Topology	6
AM3550	Graph Theory	6
AM3560	Advanced Probability	6
AM3530	Numerical Methods 2	6
AM3580	Differential Geometry	6
AM3510	Mathematical Physical Models	6

3. If the student's prior education overlaps with courses of the bridging programme these courses may be removed from the student's bridging programme.

Article 8B – Complete Bridging programme

Students will gain access to the Master's degree programme in Applied Mathematics as described in Article 7 – Subsection 1c, when they have obtained their bachelor's degree, fulfilled the language requirements of the master programme and earned a 'V' (passed) or a mark greater than or equal to 6 for all the courses in their bridging programme.

Article 9 – Goal and final attainment levels of the programme Applied Mathematics (Art. 7.13 Section 2, Subsection c WHW)

BoS right of approval

1. This master's programme is intended to impart sufficient knowledge, skills and a clear understanding of the area of Applied Mathematics, in order that the graduate is able to perform independent professional and scientific activities in the area at an academic level.
2. Graduates must meet the following specific final attainment levels:

   The graduate

   a. is familiar with the existing knowledge in the field of mathematics and its applications and is competent to extend and develop this independently by means of study.

b. is able to develop their own mathematical knowledge and insights in a focused and methodological fashion.
c. is able to develop and analyse mathematical models for problems from other disciplines and assess their usefulness.
d. has a systematic approach, characterised by the application of mathematical theories and development of mathematical methods and models, has a critical attitude.
e. has knowledge and understanding of mathematical and deductive reasoning necessary for and present in rigorous mathematical proofs and is able to apply this kind of reasoning generically.
f. can work in a team and is able to communicate mathematical knowledge verbally and in writing to specialists and non-specialists.
g. is aware of the professional, societal and ethical context in which mathematics is applied and is able to take this context into account while considering technological and societal problems.

Article 10 – General

1. The Master's degree programme in Applied Mathematics has seven specialisations and is described in Article 11A:
   a. Computational Science and Engineering;
   b. Financial Engineering;
   c. Discrete Mathematics and Optimization;
   d. Stochastics;
   e. Partial Differential Equations;
   f. Mathematics of Data Science;
   g. Mathematics of Quantum Technology and Computation.
2. An IEP consists of the following parts:
   a. Common core courses worth 6 credits;
   b. Orientation course of 6 EC;
   c. Specialisation courses worth 48 EC, of which a maximum of 12 credits may be spent on non-mathematical specialisation courses;
   d. Non-mathematical electives worth 15 credits;
   e. A thesis project worth 45 credits.
3. Students are required to gain experience as a mathematician in interdisciplinary work. This requirement can be satisfied in four ways:
   a. Through an internship of 15 EC (WI5215);
   b. Through a Joint Interdisciplinary Project (TUD4040);
   c. Through an Interdisciplinary Advanced AI Project (IFEEMCS520200);
   d. Through a graduation project performed in an interdisciplinary setting outside the Delft Institute of Applied Mathematics.

Students that have been admitted through a bridging programme (i.e., with a bachelor's degree different from (Applied) Mathematics) or that are following the SEC specialisation are exempt from this requirement.

4. The joint Master's programme in Computer Simulations for Science and Engineering (COSSE) deviates and is described in Article 11B.
5. Students who have followed the minor Science Education and Communication (SEC) in their bachelor's programme and wish to obtain the certificate granting 1st degree teacher (eerstegraads bevoegdheid) status in the Netherlands may follow the SEC specialisation (Verdiepingsdeel) at the faculty of Applied Science within their Applied Mathematics Master's programme.

Article 11 – Programme details

Article 11A – Applied Mathematics

1. The common core consists of two courses[9]:

Course code	Course name	EC
WI4800	Scientific Writing for Applied Mathematics	3
WM1028AM	Ethics for Applied Mathematics	3

2. Every specialisation has its own orientation course.

Course code	Course name	EC	Compulsory for
WI4201	Scientific Computing	6	Computational Science and Engineering
WI4227-14	Discrete Optimisation	6	Discrete Mathematics and Optimization
WI4430	Martingales, Brownian Motion	6	Stochastics
WI4635	Linear Algebra and Optimization for Machine Learning	6	Mathematics of Data Science
WI4655	Perturbation and Variational Methods for Partial Differential Equations	6	Partial Differential Equations
WI4675	Introduction to Financial Mathematics	6	Financial Engineering
WI4645	Introduction to Quantum Information and Computing	6	Mathematics of Quantum Technology and Computation

3. The specialisation consists of maximum 48 credits worth of compulsory and recommended courses as stated in the related lists below, with a maximum of 12 EC of non-mathematics courses. Additionally, students may also use two of the courses mentioned in Subsection 2 as specialisation courses. All courses listed as compulsory specialisation courses can also be chosen as recommended specialisation courses. Unlisted courses must be submitted to the Board of Examiners for approval.

[9] Students who follow the Verdiepingsdeel of SEC may replace one of the common core courses and 12 credits of non-mathematics electives in the specialisation part by 15 credits worth of SEC courses. The other 15 EC of SEC courses will be part of the non-mathematical elective space.

Specialisation courses for Computational Science and Engineering		
Course code	**Course name**	**EC**
Compulsory specialisation courses (choose 3 out of 4 courses)		
WI4019-SP	Nonlinear Differential Equations	6
WI4204	Advanced Modelling	6
WI4205	Applied Finite Elements	6
WI4475	Data Assimilation	6
The following courses are recommended		
WI4011-17	Computational Fluid Dynamics	6
WI4207	Continuous Optimization (MM-4TU)	6
WI4212	Advanced Numerical Methods	6
WI4450	Special Topics in Computational Science and Engineering	6
WI4209	Systems and Control (MM-4TU, -DISC)	6
WI4221	Control of Discrete-Time Stochastic Systems	6
MM-4TU	Inverse Problems in Imaging	6
IN4049TU	Introduction to High Performance Computing	6
WI4260TU	Scientific Programming for Engineers	3
WI4655	Perturbation and Variational Methods for Partial Differential Equations	6
WI4635	Linear Algebra and Optimization for Machine Learning	6
WI4771TU	Object Oriented Scientific Programming with C++	3
WI4520	Nonlinear Analysis and Partial Differential Equations	6
WI4680	Applications in Partial Differential Equations	6

Specialisation courses for Financial Engineering		
Course code	**Course name**	**EC**
Compulsory specialisation courses		
WI4079	Financial Mathematics	6
WI4154	Computational Finance	6
WI4430	Martingales, Brownian Motion	6
WI4201	Scientific Computing	6
The following courses are recommended		
WI4019-SP	Nonlinear Differential Equations	6
WI4230	Time series and Extreme Value Theory	6
WI4052	Risk Analysis	6
WI4156(TU)	Game Theory	6

WI4205	Applied Finite Elements	6
WI4224	Special Topics in Financial Engineering	6
WI4505	Quantative Risk Management	6
WI4614	Stochastic Simulation	6
WI4425	Financial Markets Theory	6
WI4635	Linear Algebra and Optimization for Machine Learning	6
WI4630	Statistical Learning	6
WI4771TU	Object Oriented Scientific Programming with C++	3
WI4615	Stochastic Calculus	6

Specialisation courses for Discrete Mathematics and Optimization		
Course code	**Course name**	**EC**
Compulsory specialisation courses		
MM	Semidefinite Optimization	8
Compulsory specialisation courses (choose 2 out of 4 courses)		
WI4410	Advanced Discrete Optimization	6
WI4515	Relaxations and Heuristics	6
WI4670	Extremal Combinatorics	6
WI4635	Linear Algebra and Optimization for Machine Learning	6
The following courses are recommended		
WI4207	Continuous Optimization (MM)	6
MM-STAR	Machine Learning Theory	8
MM	Quantum Computing	8
MM	Quantum Information Theory	8
MM-LNMB	Scheduling	6
WI4630	Statistical Learning	6
ET4030	Error Correcting Codes	4
WI4156(TU)	Game Theory	6
MM	Additive Combinatorics	8
MM	Graph Symmetries and Combinatorial Designs	8

Specialisation courses for Stochastics		
Course code	**Course name**	**EC**
Compulsory specialisation courses		
WI4455	Statistical Inference	6
Compulsory specialisation courses (choose 2 out of 6 courses)		

WI4230	Time series and Extreme Value Theory	6
WI4052	Risk Analysis	6
WI4665	Advanced Topics in Statistics	6
WI4615	Stochastic Calculus	6
WI4465	Advanced Topics in Probability	6
WI4630	Statistical Learning	6
The following courses are recommended		
MM-STAR	Asymptotic statistics	8
WI4050	Uncertainty and Sensitivity Analysis	6
WI4138	Decision Theory/Expert Judgment	6
WI4156(TU)	Game Theory	6
WI4640	High Dimensional Probability	6
WI4614	Stochastic Simulation	6
MM	Stochastic Processes	8
MM	Statistics for Stochastic Processes	8
WI4505	Quantitative Risk Management	6

Specialisation courses for Mathematics of Data Science		
Course code	**Course name**	**EC**
Compulsory specialisation courses		
WI4630	Statistical Learning	6
Compulsory specialisation courses (choose 2 out of 4 courses)		
WI4203	Applied Functional Analysis	6
WI4640	High Dimensional Probability	6
WI4455	Statistical Inference	6
WI4614	Stochastic Simulation	6
The following courses are recommended		
MM	Machine Learning Theory	8
WI4207	Continuous Optimization (MM)	6
WI4410	Advanced Discrete Optimization	6
WI4230	Time Series and Extreme Value Theory	6
CS4230	Machine Learning 2	5
WI4665	Advanced Topics in Statistics	6
MM	Semidefinite Optimization	8
EE4685	Machine Learning, a Bayesian Perspective	5

Specialisation courses for Partial Differential Equations		
Course code	**Course name**	**EC**
Compulsory specialisation courses (choose 2 out of 6 courses)		
WI4203	Applied Functional Analysis	6
WI4019-SP	Nonlinear Differential Equations	6
WI4520	Nonlinear Analysis and Partial Differential Equations	6
WI4660	Dynamical Systems and Chaos	6
WI4430	Martingales, Brownian Motion	6
WI4201	Scientific Computing	6
The following courses are recommended		
WI4006	Special Functions and Representation Theory	6
WI4480	Internet Seminar on Evolution Equations	9
WI4485	Harmonic Analysis	6
WI4615	Stochastic Calculus	6
WI4046	Spectral Theory of Linear Operators	6
MM	Calculus of Variations	8
WI4204	Advanced Modelling	6
WI4205	Applied Finite Elements	6
MM	Introduction to Numerical Bifurcation Analysis of ODE's and Maps	8
MM	Mathematical Biology	8
WI4211	Advanced Topics in Analysis	6
WI4680	Applications in Partial Differential Equations	6

Specialisation courses for Mathematics of Quantum Technology and Computation		
Course code	**Course name**	**EC**
Compulsory specialisation courses (choose 2 out of 4 courses)		
WI4203	Applied Functional Analysis	6
MM	Semidefinite Optimization	8
WI4006	Special Functions and Representation Theory	6
WI4650	Applied Quantum Algorithms	6
The following courses are recommended		
MM	Quantum Computing	8
MM	Quantum Information Theory	8
WI4211	Advanced Topics in Analysis	6
WI4046	Spectral Theory of Linear Operators	6

MM	Operator Algebras	8
MM	Lie Groups	8
WI4635	Linear Algebra and Optimization for Machine Learning	6
WI4207	Continuous Optimization (MM)	6
AP3452	Quantum Error Correction	4
CS4090	Quantum Communication and Cryptography	5
QIST4300	Qubit Dynamics and Quantum Control	4
QIST4320	Quantum Computation and Quantum Programming	4

4. The non-mathematics elective space may be used for:
    a. non-mathematics courses that show the role of mathematics in applications and society (see the digital Study Guide for course options);
    b. homologation, i.e., courses at bachelor's level required to obtain the necessary prior knowledge for a course at master's level (for students with a bachelor's degree different from (applied) mathematics);
    c. courses of the verdiepingsdeel of SEC;
    d. the Interdisciplinary Advanced AI Project (IFEEMCS520200);
    e. the Joint Interdisciplinary Project (TUD4040);
    f. an internship of 15 (WI5215) credits;

    A maximum of 3 credits may be spent on language courses, for example:

Course code	**Course name**	**EC**
WM1135TU	Advanced English for the University	3
TPM301B	Spoken English for Academic Purposes - Intermediate	2
TPM302B	Spoken English for Academic Purposes - Advanced	2
TPM303A	Intermediate Writing in English for the University	2
TPM304A	Advanced Writing in English for the University	2
TPM305A	Writing a Master's Thesis in English	2

    Please note: Language courses may only be chosen if required. Placement tests showing the necessity to take one or more of these courses must be taken and submitted to the master coordinator.

5. The thesis project is performed under supervision of (at least) one of the research groups at DIAM.

    In case an external thesis project is mandatory (for students that do not have the internship, IAAIP or JIP as part of their IEP), the course code is WI5010EXT. The code for students that are free to choose between an external or internal project is WI5010. Students that are exempt from the requirement to gain experience as a mathematician in interdisciplinary work should use the code WI5010 for their thesis project in any case.

Article 11B – The joint Master's Programme in Computer Simulations for Science and Engineering (COSSE)

1. Students in the joint Master's programme in Computer Simulations for Science and Engineering (COSSE) follow the programme composed by the partners TU Delft, TU Berlin and KTH. This programme requires that students attend different universities in the first and the second year.
2. An IEP of students in the programme at Delft University of Technology in their first year matches the requirements of the first year of the specialisation Computational Science and Engineering and consists of:
   a. The common core courses;
   b. The orientation course WI4201 Scientific Computing;
   c. Compulsory specialisation courses (choose 3 out of 4 courses);
   d. 30 EC worth of recommended specialisation courses
3. The common core courses consist of the following courses:

Course code	Course name	EC
WM1028AM	Ethics for Applied Mathematics	3
WI4800	Scientific Writing for Mathematics	3

4. The orientation course is:

Course code	Course name	EC
WI4201	Scientific Computing	6

5. The specialisation courses

Course code	Course name	EC
Compulsory specialisation courses (choose 3 out of 4 courses)		
WI4204	Advanced Modelling	6
WI4205	Applied Finite Elements	6
WI4475	Data Assimilation	6
WI4019-SP	Nonlinear Differential Equations	6
The following courses are recommended (choose 30 EC)		
MM	Inverse Problems in Imaging	8
IN4049TU	Introduction to High Performance Computing	6
WI4011-17	Computational Fluid Dynamics	6
WI4450	Special Topics in Computational Science and Engineering	6
WI4207	Continuous Optimization	6
WI4212	Advanced Numerical Methods	6
WI4209	Systems and Control	6
WI4221	Control of Discrete-Time Stochastic Systems	6
WI4771TU	Object Oriented Scientific Programming	3

WI4635	Linear Algebra and Optimization for Machine Learning	6
WI4260TU	Scientific Programming for Engineers	3
WI4520	Nonlinear Analysis and Partial Differential Equations	6
WI4680	Applications in Partial Differential Equations	6

Other courses will be considered by the Board of Examiners if and when requested.

6. An IEP of students in the programme at Delft University of Technology in their second year consists of:
   a. Specialisation courses worth at least 18 credits
   b. A Seminar/Literature Study worth 12 credits (WI5001COSSE)
   c. The thesis project worth 30 credits (WI5000COSSE)

   The specialisation courses from the following list:

Course code	Course name	EC
WI4011-17	Computational Fluid Dynamics	6
WI4475	Data Assimilation	6
WI4207	Continuous Optimization	6
WI4212	Advanced Numerical Methods	6
WI4450	Special Topics in Computational Science and Engineering	6
WI4209	Systems and Control (MM-4TU, -DISC)	6
WI4635	Linear Algebra and Optimization for Machine Learning	6
WI4221	Control of Discrete-Time Stochastic Systems	6
IN4049TU	Introduction to High Performance Computing	6
WI4260TU	Scientific Programming for Engineers	3
MM	Inverse Problems in Imaging	6
WI4204	Advanced Modelling	6
WI4205	Applied Finite Elements	6
WI4019-SP	Nonlinear Differential Equations	6
WI4771TU	Object Oriented Scientific Programming with C++	3
WI4520	Nonlinear Analysis and Partial Differential Equations	6
WI4680	Applications in Partial Differential Equations	6

Other courses will be considered by the Board of Examiners if and when requested.

7. A thesis project as described in Article 3 worth 30 credits.
8. The Delft University of Technology Applied Mathematics Master's degree will be awarded:
   - if a student has earned a 'V' (passed) or a mark that is greater than or equal to 6, for all study units of the IEP of the COSSE Master's programme at Delft University of Technology in the first year and has passed all study units of the second year of the COSSE Master's programme at one of the other COSSE universities; or
   - if a student has passed all study units of the first year of the COSSE Master's programme at one of the other COSSE universities and has earned a 'V' (passed) or a mark that is greater than or equal

to 6 for all study units of the IEP at Delft University of Technology in the second year of the COSSE Master's programme. This implies that the IEP should satisfy the requirements of the Delft University of Technology Applied Mathematics Master's degree.

Part 2B – Computer and Embedded Systems Engineering

Article 12 – Admission to the Master's degree programme Computer and Embedded Systems Engineering (Art. 7.30b WHW)

1. **Degrees from Dutch higher education institutions**

   Individuals holding one of the following degrees have access to the education of the Master's degree programme in Computer and Embedded Systems Engineering on the condition that the stated requirements have been met.

   a. Bachelor's degree in Electrical Engineering or Computer Science & Engineering (Technische Informatica) from Delft University of Technology, Eindhoven University of Technology or University of Twente; or

   b. Bachelor degree in Electrical Engineering or Computer Science & Engineering (TI) from a Dutch HBO institution in combination with a completed bridging programme in Computer and Embedded Systems Engineering from the TU Delft; or

   c. Bachelor's degree in Mechanical Engineering, Applied Physics and Aerospace Engineering from Delft University of Technology and a completed bridging programming in Computer and Embedded Systems Engineering from TU Delft.

   Students who possess a Dutch bachelor's degree not mentioned above are required to obtain proof of admission to the programme from the dean, who will seek the advice of the admission committee on this matter.

2. **Degrees from foreign higher education institutions**

   Individuals holding a foreign bachelor's degree will be assessed on an individual basis by the admission committee.

   a. The following quantitative admission requirements must be met:

      1) Bachelor's degree in Electrical Engineering or Computer Science, and

      2) a minimum bachelor's Cumulative Grade Point Average (CGPA), specific requirements are defined per country (see website). If the country is not listed in the overview, the required minimum CGPA is 75%, and

      3) English language proficiency, the requirements can be found in Article 33 in the Implementation Regulations (appendix I). Implementation

   b. The following qualitative admission requirements also apply:

      1) Scores for key subjects must be good;

      2) For the master's degree programme in Computer and Embedded Systems Engineering sufficient knowledge of the following key subjects is required:

         - mathematics (Calculus, Linear Algebra, Numerical Analysis, Differential Equations)
         - probability and statistics
         - computer architecture
         - programming (especially C language)

3) GRE test scores in Verbal Reasoning, Quantitative Reasoning and Analytical Writing. Minimum GRE scores that must be achieved to be eligible for admission are not set, but the Computer and Embedded Systems Engineering programme looks for applicants who attain a minimum score of 154 for Verbal Reasoning, 163 for Quantitative Reasoning and 4.0 for Analytical Writing. The faculty reserves the right to reject applicants who do not have these scores.

c. In addition, candidates are required to submit a CV and a motivation statement.

3. **Admission to the programme 2024-2025**
   Subsection 2 of this Article applies, but additionally:
   a. For EER students with an international BSc degree, a rolling admission applies with an application deadline of April 1st 2024. Enrolment is only possible per September 1st.
   b. For non-EER students with an international BSc degree the application deadline is January 15th 2024. There will be a selective admission on the basis of submitted materials. Enrolment is only possible per September 1st.

   Details of the application procedure and deadlines are published on the website.

Article 13A – Bridging programmes for professional education graduates

1. Students having obtained an 'HBO degree' from a Dutch institute of professional education in Computer, Science and Engineering can gain access to the Master's degree programme Computer and Embedded Systems Engineering (CESE) via a bridging programme.

   The bridging programme contains the following courses:

Course code	Course name	EC
IFEEMCS011100	Calculus for Science 1	3
IFEEMCS011200	Calculus for Science 2	3
CSE1205	Linear Algebra	5
WI1909TH	Differential Equations	3
IFEEMCS010500	Probability and Statistics	5
CSE1300	Reasoning and Logic	5
CSE2420	Digital Systems	5
CSE2310	Algorithm Design	5
EE8002	Literature Study for Electrical Engineering	2
CSE2315	Automata, Languages and Computability	5
CSE1110	Software Quality and Testing	5
Choose one of the courses below:		
EE3D11	Computer Architecture and Organisation	5
CSE2430	Operating Systems	5

2. Students having obtained an 'HBO degree' from a Dutch institute of professional education in Electrical Engineering (Elektrotechniek) can gain access to the Master's degree programme Computer and Embedded Systems Engineering (CESE) via a bridging programme.

   The bridging programme contains the following courses:

Course code	Course name	EC
IFEEMCS011100	Calculus for Science 1	3
IFEEMCS011200	Calculus for Science 2	3
IFEEMCS010400	Linear Algebra	5
WI1909TH	Differential Equations	3
EE2S11	Signals and Systems	5
EE3D11	Computer Architecture and Organisation	5
EE2S21	Systems and Control	5
CSE1100	Object Oriented Programming	5
EE8002	Literature Study for Electrical Enginering	2
IFEEMCS010500	Probability and Statistics	5
CSE1405	Computer Networks	5

Article 13B – Bridging programmes for research university graduates

1. Students having obtained a bachelor's degree from the following bachelor programmes at the TU Delft can gain access to the Master's degree programme of Computer and Embedded Systems Engineering (CESE) via a bridging programme:
   a. Mechanical Engineering
   b. Aerospace Engineering
   c. Applied Physics

   The bridging programme contains the courses listed below.

Course code	Course name	EC
CSE2420	Digital Systems	5
EE3115TU	Digital Communication Systems	4
EE3125TU	Advanced Electronics for Robotics	5
ET3033TU	Circuit Analyses	3
ET3604LR	Electronic Circuits	3
EE3130	Marsrover project	5
CSE2425	Embedded Software	5

   If the student's prior education overlaps with courses of the bridging programme these courses may be removed from the student's bridging programme.

Article 13C – Complete Bridging programme

Students will gain access to the Master's degree programme in Computer and Embedded Systems Engineering as described in Article 12 – Subsection 1b, 1c, when they have obtained their bachelor's degree, fulfilled the language requirements of the master programme and earned a 'V' (passed) or a mark greater than or equal to 6 for all the courses in their bridging programme.

Article 14 – Goal and final attainment levels of the programme Computer and Embedded Systems Engineering (art. 7.13 Section 2, Subsection c WHW)

1. Scientific discipline
   The graduate has sufficient knowledge, skills and a clear understanding of computer and embedded systems engineering, enabling the graduate to perform independent professional and scientific activities in this field at an academic level.

   This consists of:

   a. an all-embracing view on computer engineering and embedded systems, their design and their application in systems of various sizes, including their evolution over time, demonstrated by a comprehensive approach in system design.
   b. the capability to analyse the functional behaviour of complex computer hardware and embedded systems in a structural way, using appropriate abstractions
   c. the ability to describe and evaluate the non-functional aspects of computation platforms (hardware and soft- ware) and the surrounding system (sensors and actuators), e.g., resource boundedness and dependability
   d. a thorough knowledge of state-of-the-art and emerging methods and technologies for computer and embedded systems engineering such as requirements engineering, hardware-software integration, performance modelling and analysis, validation and testing, computer architectures, computer arithmetic, compiler construction and code generation.
2. Doing research

   The graduate is able to conduct research independently that contributes to the development of scientific knowledge about the application of computer and embedded systems engineering to address complex problems.
3. Designing

   The graduate is able to design computer architectures and embedded systems that satisfy functional and non-functional requirements, taking into account the performance of the system during its lifetime.
4. Scientific approach

   The graduate has a scientific approach to complex problems and ideas, i.e., the graduate can define a research or engineering problem, choose an appropriate approach, and complete that project.
5. Intellectual skills

   The graduate has intellectual skills befitting an academic graduate.

   This includes:

   a. the ability to reflect critically, reason and form opinions
   b. the capability to continue their studies in a manner that is largely self-directed, self-regulated and self-motivated (lifelong learning)
6. Cooperating and communicating

   The graduate is capable of working in interdisciplinary teams, performing research or design activities and communicating easily in English, both in writing and orally.

   This includes:

a. the attitude to include other disciplines or involve practitioners of these disciplines in their work, where necessary
b. the ability to collaborate in multi-disciplinary settings, where necessary
c. the ability to communicate the results of their findings, thinking and decision-making processes at an international level.

7. Temporal and social context

   The graduate is aware of actions and consequences related to these actions on society and vice versa.

   This includes:

   a. being aware of the temporal, social and ethical context of science and technology (comprehension and analysis) and being able to integrate this context responsibly in their scientific work
   b. the ability to appraise costs and environmental issues in order to make optimal use of available resources

Article 15 – General

1. The individual examination programme has a study load of 120 credits and consists of:
   a. Common core courses worth 25 credits, including a homologation course worth 5 credits
   b. Compulsory integration set courses worth 20 credits[10]
   c. Courses from one of the specialisation lists, worth at least 13 credits,
   d. Free elective courses worth at least 15 credits
   e. A thesis project worth 45 credits (CESE5000 Final Project).

If the total number of credits under subsection a to subsection e is lower than 120 credits the IEP should be completed with free electives to a minimum of 120 credits.

Students are allowed to choose elective subjects from the lists of electives from each of the 3 programmes, after approval by the Board of Examiners of the home university.

Article 16 – Programme details

1. The common core courses are:

Course code	Course name	EC
CESE4000*	Software Fundamentals	5
CESE4005**	Hardware Fundamentals	5
CESE4010	Advanced Computing Systems	5
EE4C11	Systems Engineering	5
CESE4015	Software Systems	5
CESE4020	Effective and Responsible Engineering	5

* Homologation course for students with a Bachelor's degree Electrical Engineering
** Homologation course for students with a Bachelor's degree Computer Science

[10] Students doing the specialisation Control can opt to take 10 EC of Control specialisation courses instead of the CE Integration set CESE4035, CSES4040.

2. Compulsory integration set courses

Course code	Course name	EC
Embedded Systems Integration set		
CESE4025	Real-time Systems	5
CESE4030	Embedded Systems Laboratory	5
Computer Engineering Integration set		
CESE4035	Computer Arithmetic	5
CESE4040	Processor Design Project	5

3. Courses from one of the specialisation lists, worth at least 15 credits:

   Students must select all specialisation courses in consultation with their prospective thesis advisor. All courses should relate to a Computer and Embedded Systems Engineering thesis subject. IEPs containing courses that are not part of one of the mentioned lists require specific approval from the board of examiners.

   The four specialisations are:

   a. Computer Architecture
   b. Software
   c. Networking
   d. Control

Computer Architecture Specialisation course list		
Course code	**Course name**	**EC**
CESE4075	Supercomputing for Big Data	5
CESE4095	System Design with HDLs	2
EE4700	Modeling, Algorithms and Data Structures	5
EE4610	Digital IC Design I	3
CESE4085	Modern Computer Architectures	5
CESE4090	Reconfigurable Computing Design	5
QIST4400	Quantum Computing Architecture	5
EE4615	Digital IC Design II	3
EE4695	Hardware Dependability	5
EE4690	Hardware Architectures for Artificial Intelligence	5
ET4351	Digital VLSI Systems on Chip	4
ET4362	High Speed Digital Design for Embedded Systems	5
CESE4115	Embedded Computer Architecture 2	5

Software Specialisation course list		
Course code	**Course name**	**EC**
CESE4075	Supercomputing for Big Data	5
IN4191	Security and Cryptography	5
CS4375	Artificial Intelligence Techniques	5
CS4200-A	Compiler Construction A	5
IN4344	Advanced Algorithms	5
IN4049TU	Introduction to High Performance Computing	6
IN4150	Distributed Algorithms	6
IN4315	Software Architecture	5
CS4210-A	Algorithms for Intelligent Decision Making	5
CS4240	Deep Learning	5
CS4205	Evolutionary Algorithms	5
CESE4120	Smart Phone Sensing	5
CS4220	Machine Learning 1	5

Networking specialisation course list		
Course code	**Course name**	**EC**
EE4C06	Networking	5
CESE4055	Ad-hoc and Sensor Networks	5
CESE4065	Advanced Practical I.o.T. and Seminar	5
CESE4045	High-performance data networking	5
ET4358	Fundamentals of Wireless Communications	5
CS4090	Quantum communication and cryptography	5
IN4341	Performance Analysis	5
CESE4050	Measuring and Simulating the Internet	5
CESE4060	Wireless IoT and Local Area Networks	5
CS4430	Network Security	5
EE4630	Telecommunication Network Architectures	3
EE4396	Mobile Networks	5
SC42101	Networked & Distributed Control Systems	4
ET4034	Telecom Business Architectures and Models	4
CESE4120	Smart Phone Sensing	5
CESE4110	Visible Light Communication & Sensing	5

Control specialisation course list		
Course code	**Course name**	**EC**
SC42001	Control System Design	3
SC42015	Control Theory	6
SC42056	Optimization in Systems and Control	4
SC42150	Statistical Signal Processing	3
SC42155	Modelling of Dynamical Systems	3
SC42025	Filtering & Identification	6
SC42061	Nonlinear Systems Theory	4
SC42095	Control Engineering	3
SC42130	Fault Diagnosis and Fault Tolerant Control	4
SC42145	Robust Control	3
RO47019	Intelligent control systems	4
SC42125	Model Predictive Control	4
SC42101	Networked & Distributed Control Systems	4
SC42075	Modeling and Control of Hybrid Systems	3
SC42110	Dynamic Programming & Stochastic Control	5

4. Free elective courses worth at least 15 credits. The free elective space may be used for additional specialisation courses, a project or internship, language courses or courses from other master's programmes.

Projects and internship		
Course code	**Course name**	**EC**
CESE5010	Industry Internship	15
CESE5020	Research Internship (10-15 EC)	10-15
TUD4040	Joint Interdisciplinary Project (JIP)	15
IFEEMCS520200	Interdisciplinary Advanced Artificial Intelligence Project	15

Please note:
Students may choose only one project or internship (10-15 EC) from the list above. Students with a bachelor's degree from a Dutch HBO institution who have had 30 credits or more worth of work experience in their prior education, may not include the Industry Internship in their IEP. Students who wish to carry out their thesis project outside TU Delft (i.e., in a company or other organisation) in any case may not include the Industry Internship in their IEP.

The research Internship and the thesis project must be in different research groups.

Language courses		
Course code	**Course name**	**EC**
TPM018A	English Grammar for the University	2
TPM302B	Spoken English for Academic Purposes - Advanced	2
TPM303A	Intermediate Writing in English for the University	2
TPM304A	Advanced Writing in English for the University	2
TPM305A	Writing a Master's Thesis in English	2
WM1115TU	Dutch Elementary 1	3
WM1116TU	Dutch Elementary 2	3
WM1117TU	Dutch intermediate 1	3
WM1135TU	Advanced English for the University	3

Please note:
Up to 6 credits may be spent on language courses. Placement tests showing the necessity to take one or more of these courses must be taken and submitted to the master coordinator.

5. Thesis project

   The thesis project is worth 45 EC.

Course code	Course name	EC
CESE5000	Thesis Project	45

Part 2C – Computer Science

Article 17 – Admission to the Master's degree programme Computer Science (Art. 7.30b WHW)

1. **Degrees from Dutch higher education institutions**

   Individuals holding one of the following degrees have access to the education of the Master's degree programme in Computer Science on the condition that the stated requirements have been met.

   a. Bachelor's degree in Computer Science & Engineering (Technische Informatica) from Delft University of Technology, Eindhoven University of Technology or University of Twente; or

   b. Bachelor's degree in Computer Science from a Dutch research university; or

   c. Bachelor's degree in Electrical Engineering or Applied Mathematics from Delft University of Technology, and a completed bridging programming in Computer Science & Engineering from TU Delft; or

   d. Bachelor's degree Computer Science & Engineering from a Dutch HBO institution (TI) in combination with a completed bridging programme in Computer Science & Engineering from TU Delft.

   Students who possess a Dutch bachelor's degree not mentioned above are required to obtain proof of admission to the programme from the dean, who will seek the advice of the admission committee on this matter. The admission committee will uphold the same qualitative requirements as mentioned in Subsection 3C2 below: first and second item (no GRE required).

2. **Degrees from foreign higher education institutions**

   Individuals holding a foreign bachelor's degree will be assessed on an individual basis by the admission committee.

   a. The following general selection requirements must be met:

      1) a Bachelor's degree in Computer Science or equivalent, and

      2) a minimum bachelor's Cumulative Grade Point Average (CGPA), specific requirements are defined per country (see website). If the country is not listed in the overview, the required minimum CGPA is 75%, and

      5) English language proficiency, the requirements can be found in Article 33 in the Implementation Regulations (appendix I).

   b. The following qualitative admission requirements also apply:

      1) Good academic performance in Computer Science subjects with a combined study load of at least 120 EC, of which at least 100 EC in key subjects and minimum number of EC per key area as indicated below.

      2) For the master's degree programme in Computer Science the key subjects are defined as:

         - Mathematics and Modelling (Calculus, Linear Algebra, Probability Theory and Statistics) – minimum 15 EC

- Software Development Fundamentals (Object Oriented Programming, Software Quality and Testing, Software Engineering Methods, Concepts of Programming Languages, Object Oriented Programming Project, Software Project) – minimum 30 EC
- Computer Systems (Computer Organisation, Computer Networks) – minimum 10 EC
- Fundamental Computer Science (Logic, Algorithms and Data Structures, Algorithm Design, Computability) – minimum 15 EC
- Data and Information Systems (Machine Learning, Data Management, Web- & Database Technology) – minimum 15 EC;

3) GRE test scores in Verbal Reasoning, Quantitative Reasoning and Analytical Writing. Minimum GRE scores that must be achieved to be eligible for admission are not set, but the Computer Science programme expects applicants to attain a minimum score of 154 for Verbal Reasoning, 163 for Quantitative Reasoning and 4.0 for Analytical Writing. The faculty reserves the right to reject applicants who do not have these scores.

c. In addition, candidates are required to submit a CV and a motivation statement.

3. **Admission to the programme 2024-2025**

Article 3C2 applies, but additionally:

a. For EER students with an international BSc degree, a rolling admission applies with an application deadline of April 1st 2024. Enrolment is only possible per September 1st.

b. For non-EER students with an international BSc degree the application deadline is January 15th 2024. There will be a selective admission on the basis of submitted materials. Enrolment is only possible per September 1st.

c. The MSc Computer Science strives for diverse and balanced student population.

Details of the application procedure and deadlines are published on the website.

Article 18 – Bridging programmes

Article 18A – For professional education graduates

1. Students having obtained a relevant bachelor's degree in Computer Science & Engineering (TI) from a Dutch institute of professional education (HBO) can gain access to the Master's degree programme of Computer Science (CS) via a bridging programme.
2. The bridging programme for Computer Science consists of the following courses:

Course code	Course name	EC
CSE1200	Calculus	5
CSE1205	Linear Algebra	5
CSE1300	Reasoning and Logic	5
CSE1110	Software Quality and Testing	5
CSE2310	Algorithm Design	5
CSE1505	Information and Data Management	5
CSE1210	Probability Theory and Statistics	5

CSE2315	Automata, Languages and Computability	5
CSE2510	Machine Learning	5

Article 18B – For research university graduates

1. Students having obtained a bachelor's degree from the following bachelor programmes of the TU Delft, can gain access to the Master's degree programme of Computer Science (CS) via a bridging programme:
   a. Electrical Engineering
   b. Applied Mathematics
2. The bridging programme for Computer Science consists of the courses listed below.

Course code	**Course name**	**EC**
CSE1300*	Reasoning and Logic	5
CSE1110	Software Quality and Testing	5
CSE1500	Web and Database Technology	5
CSE1505	Information and Data Management	5
CSE2315	Automata, Languages and Computability	5
CSE2115	Software Engineering Methods	5
CSE2510	Machine Learning	5
Choose one out of two:		
CSE1100	Object-oriented programming	5
CSE2120	Concepts of Programming Languages	5
Choose one out of two:		
CSE1305	Algorithms and Data Structures	5
CSE2310	Algorithms Design	5

*students from Applied Mathematics are exempted for this course.

3. If the student's prior education overlaps with courses of the bridging programme these courses may be removed from the student's bridging programme.

Article 18C – Complete Bridging programme

Students will gain access to the Master's degree programme in Computer Science as described in Article 17 – Subsection 1c ,1d when they have obtained their bachelor's degree, fulfilled the language requirements of the master programme and earned a 'V' (passed) or a mark greater than or equal to 6 for all the courses in their bridging programme.

Article 19 – Goal and final attainment levels of the programme Computer Science (art. 7.13 Section 2, Subsection c WHW)

1. This master's programme is intended to impart sufficient knowledge, skills and a clear understanding of the area of Computer Science, in order that the graduate is able to perform independent professional and scientific activities in the area at an academic level.
2. Graduates must also meet the specific final attainment levels for this degree programme, as listed below:
    a. have general knowledge of computer science and the relevant issues of mathematics and computer engineering.
    b. have in-depth knowledge in either Software Technology, in Data Science and Technology or in Artificial Intelligence and have demonstrated the ability to apply it through a master's thesis project.
    c. are able to identify, analyse model and solve problems and to implement and test solutions within their chosen domains for a broad range of application areas.
    d. know how to work individually and in teams.
    e. are able to analyse and conceptualise at a formal and abstract level.
    f. understand the fundamental issues of this field and contribute to research and the further development of the field.
    g. position their contributions within the wider scope of the overall development of science and technology, as well as within industry and society.
    h. are able to communicate (orally and in writing) about results and methodology to their colleagues in the professional field, as well as to lay audiences.

Article 20 – General

1. The Master’s degree programme in Computer Science has three tracks, Data Science & Technology, Software Technology and Artificial Intelligence Technology, described in detail in Article 21A and Article 21B.
2. Students may opt for one of the special programmes in Bioinformatics, Cyber Security or Information Architecture (Article 21B), which will be mentioned on the student’s diploma supplement under Specialisation.

Article 21 – Programme details

Article 21A – The tracks Data Science & Technology (DST), Software Technology (ST) and Artificial Intelligence Technology (AIT) without special programme

1. An IEP in these tracks has a study load of 120 credits and consists of
    a. a common core,
    b. Computer Science specialisation courses,
    c. a course that provides students with knowledge of the research methods within the field of Computer Science or a Literature survey (IN4306),
    d. free electives: courses at academic master's level that may be chosen freely,

e. a thesis project (IN5000 Final project) worth 45 credits

f. and if required, homologation.

2. The thesis project is carried out under supervision of one of the EEMCS research groups that are part of the Departments Software Technology or Intelligent Systems.
3. The IEP must be drawn up in agreement with the IEP reviewer of one of the research groups in which the student wishes to carry out their thesis project. The IEP reviewer is a member of the scientific staff of that research group. (Article 4 Subsection 1)
4. The IEP should be composed as follows:
   a. Students of the Data Science & Technology track choose 4 out of 7 common core courses from the related following lists:

Data Science & Technology common core (choose 4 out of 7)		
Course code	**Course name**	**EC**
CS4035	Cyber data analytics	5
CS4375	Artificial Intelligence Techniques	5
IN4089	Data Visualization	5
IN4252	Web Science & Engineering	5
IN4344	Advanced Algorithms	5
IN4315	Software Architecture	5
CS4220	Machine Learning 1	5

   b. Students of the Software Technology track choose 5 out of 10 common core courses from the related following lists:

Software Technology common core (choose 5 out of 10)		
Course code	**Course name**	**EC**
IN4152	3D Computer Graphics and Animation	5
CS4015	Behaviour Change Support Systems	5
IN4150	Distributed Algorithms	6
IN4191	Security and cryptography	5
IN4252	Web Science & Engineering	5
IN4344	Advanced Algorithms	5
CS4200-A	Compiler Construction	5
CESE4025	Real-time Systems	5
IN4315	Software Architecture	5
CS4220	Machine Learning 1	5

   c. Students of the Artificial Intelligence Technology track choose 4 out of 8 common core courses from the related following lists:

Artificial Intelligence Technology common core (choose 4 out of 8)		
Course code	**Course name**	**EC**
CS4220	Machine Learning 1	5
IN4315	Software Architecture	5
CS4375	Artificial Intelligence Techniques	5
CS4210-A	Algorithms for Intelligent Decision Making	5
CS4240	Deep Learning	5
IN4325	Information Retrieval	5
CS4205	Evolutionary Algorithms	5
CS4270	Conversational Agents	5

d. at least 15 credits worth of courses chosen from the list of Computer Science specialisation courses published in the digital Study Guide.

e. The seminar or a Literature Study (IN4306) is part of said IEP. The Literature Study as well as the courses in this list below provide students with knowledge of the research methods within the field of Computer Science.

Seminars, Literature Study		
Course code	**Course name**	**EC**
IN4326	Seminar Web Information Systems	5
CESE4065	Advanced Practical I.o.T. and Seminar	5
CS4165	Seminar Social Signal Processing	5
IN4314	Seminar Selected Topics in Multimedia Computing	5
CS4130	Seminar Programming Languages	5
IN4310	Seminar Computer Graphics	5
IN4334	Analytics and Machine Learning for Software Engineering	5
CS4125	Seminar Research Methodology for Data Science	5
CS4245	Seminar Computer Vision by Deep Learning	5
CS4120	Seminar Cyber Security	5
CS4290	Seminar Distributed Machine Learning Systems	5
CS4210-B	Intelligent Decision Making Project	5
CS4340	Seminar Probalistic Programming	5
CS4345	Seminar Formal Methods for Learned Systems	5
IN4306	Literature Survey	10

f. the number of credits spent on free electives in said IEP is no higher than 25 credits. See the digital Study Guide for course options. A language course may be part of the IEP. See the list and requirements below.

Language courses		
Course code	**Course name**	**EC**
TPM018A	English Grammar for the University	2
TPM303A	Intermediate Writing in English for the University	2
TPM304A	Advanced Writing in English for the University	2
TPM305A	Writing a Master's Thesis in English	2
WM1115TU	Dutch Elementary 1	3
WM1116TU	Dutch Elementary 2	3
WM1117TU	Dutch intermediate 1	3
WM1135TU	Advanced English for the University	3

Please note: Up to 3 credits may be spent on language courses, these may only be chosen if required. Placement tests showing the necessity to take one or more of these courses must be taken and submitted to the master coordinator.

The free elective space may also be used for the Joint Interdisciplinary Project (JIP) or the Interdisciplinary Advanced Artificial Intelligence Project (IAAIP).

Course code	Course name	EC
TUD4040	Joint Interdisciplinary Project (JIP)	15
IFEEMCS520200	Interdisciplinary Advanced Artificial Intelligence Project (IAAIP	15

g. the number of credits spent on homologation in said IEP is no higher than 15 credits,
h. at least 40 credits of the courses in the IEP (notwithstanding the thesis project) should be Computer Science courses. A list of these courses is published annually in the digital Study Guide.

Article 21B – The tracks Data Science & Technology (DST), Software Technology (ST) and Artificial Intelligence Technology (AIT) with special programme

1. Students may opt for a Special programme in Bioinformatics, Cyber Security or Information Architecture.
2. An IEP in these tracks has a study load of 120 credits and consists of
    1. The courses required by the special programmes (see below);
    2. a thesis project (IN5000 Final project) worth 45 credits.

The special programme in Bioinformatics

1. Students in the special programme in Bioinformatics follow the Data Science & Technology, Software Technology or Artificial Intelligence Technology track. (Article 21A, Subsection 4a, 4b, 4c).
2. General set-up of the special programme in Bioinformatics

Bioinformatics	
Set-up of the programme	**EC**
The common core courses of the selected track:	
ST track (choose 5 out of 10)	≥ 25 EC
DST track (choose 4 out of 7)	≥ 20 EC
AIT track (choose 4 out of 8)	≥ 20 EC
Bioinformatics core courses	25 EC
Bioinformatics specialisation courses	≥ 15 EC
Literature Study	10 EC
Free electives	≥ 10 EC
Thesis Project	45 EC

3. Compulsory Bioinformatics courses (25 EC)

Compulsory Bioinformatics courses		
Course code	**Course name**	**EC**
CS4250	Selected topics in molecular biology	5
CS4255	Algorithms for sequence-based bioinformatics	5
CS4176	Algorithms for network-based bioinformatics	5
CS4260	Machine learning in bioinformatics	5
CS4329	Recent topics in bioinformatics	5

4. Specialisation courses: choose at least 15 EC:

Bioinformatics specialisation Courses		
Course code	**Course name**	**EC**
Bioinformatics specialisation courses Q1		
CS4070	Multivariate Data Analysis	5
EE4C06	Networking	5
IN4049TU	Introduction to High Performance Computing	6
IN4252	Web Science & Engineering	5
IN4344	Advanced Algorithms	5
CS4375	Artificial Intelligence Techniques	6
IN4307	Medical Visualization	5
Bioinformatics specialisation courses Q2		
CS4220	Machine Learning 1	5
IN4089	Data Visualization	5
IN4150	Distributed Algorithms	6
Bioinformatics specialisation courses Q3		

CS4240	Deep Learning	5
CS4195	Modeling and Data Analysis in Complex Networks	5
CS4230	Machine Learning 2	5
IN4325	Information Retrieval	5
IN4315	Software Architecture	5
Bioinformatics specialisation courses Q4		
CS4205	Evolutionary Algorithms	5
IN4331	Web-scale Data Management	5
CS4290	Seminar Distributed Machine Learning Systems	5
CS4245	Seminar Computer Vision by Deep Learning	5

5. Literature Study (10 EC)

Course code	Course name	EC
IN4306	Literature Study	10

6. Thesis Project (45 EC)
   The thesis is performed under supervision of the Pattern Recognition & Bioinformatics research group.

Course code	Course name	EC
IN5000	Master Thesis Project	45

The special programme in Cyber Security

1. Students in the special programme in Bioinformatics follow the Data Science & Technology, Software Technology or Artificial Intelligence Technology track. (Article 21A, Subsection 4a, 4b, 4c).
2. General set-up of the special programme in Cyber Security

Cyber Security	
Set-up of the programme	**EC**
Cyber Security core courses Students have to complete two additional common core courses from their respective tracks	25 EC 10 EC
Technical electives	≥ 15 EC
Socio-Technical electives	≥ 15 EC
Seminar Cyber Security	5 EC
Thesis Project	45 EC
Free electives	≥ 5 EC

3. Compulsory Cyber Security common courses (25 EC). Students have to complete two additional common core courses from their respective tracks

Compulsory Cyber Security courses		
Course code	**Course name**	**EC**
CS4430	Network Security	5
IN4191	Security and Cryptography	5
TPM027a	Cyber risk management	5
CS4035	Cyber data analytics	5
CS4150	Systems Security	5

4. Technical electives: choose at least 3 courses

Technical elective courses		
Course code	**Course name**	**EC**
IN4253ET	“Hacking Lab"-Applied Security Analysis	5
CS4380	Privacy Enhancing technologies	5
QIST4310	Fundamentals of quantum information	4
CS4090	Quantum communication and cryptography	5
CS4160	Blockchain Engineering	5
CS4110	Software Testing and Reverse Engineering	5
CS4280	Language Based Software Security	5

5. Socio-Technical Electives: choose at least 3 courses

Socio-Technical elective courses		
Course code	**Course name**	**EC**
TPM010a	Cyber Crime Science	5
TPM020b	Economics of Security	5
TPM025a	User-Centred Security	5
TPM030a	Introduction to Cloud as Infrastructure: The effects of the new business of computing on practice	5

6. Required seminar course for graduation

Course code	**Course name**	**EC**
CS4120	Seminar Cyber Security	5

7. Thesis Project (45 EC)
   The thesis is performed under supervision of the Cyber Security research group.

Course code	**Course name**	**EC**
IN5000	Master Thesis Project in Cyber Security	45

8. Free electives: the remaining credits to make up the programme are chosen in consultation with the special programme coordinator from Cyber Security.

The special programme in Information Architecture

1. Students in the special programme in Information Architecture may choose between the Data Science & Technology, Artificial Intelligence Technology and the Software Technology track.
2. Students take the compulsory Information Architecture courses and fulfil the requirements of the chosen track (Article 21A, Subsection 4a, 4b, 4c).
3. Compulsory Information Architecture courses:

Compulsory Information Architecture courses		
Course code	**Course name**	**EC**
IN4252	Web Science & Engineering	5
IN4325	Information Retrieval	5
IN4331	Web-scale Data Management	5
SEN1141	Managing Multi Actor Decision Making	5
SEN1611	I&C Architecture Design	5
SEN1622	I&C Service Design	5
SEN1121	Complex Systems engineering	5

4. In addition to said compulsory Information Architecture courses:
   a. Students of the Data Science & Technology and Artificial Intelligence Technology track need to take 3 additional common core courses.
   b. Students of the Software Technology track need to take 4 additional common core courses.
5. Thesis Project (45 EC)
   The thesis is performed under supervision of the Web Information Systems research group.

Part 2D – Electrical Engineering

Article 22 – Admission to the Master's degree programme Electrical Engineering (Art. 7.30b WHW)

1. **Degrees from Dutch higher education institutions**

   Individuals holding one of the following degrees have access to the education of the Master's degree programme in Electrical Engineering on the condition that the stated requirements have been met.

   a. Bachelor's degree in Electrical Engineering from Delft University of Technology, Eindhoven University of Technology or University of Twente; or

   b. Bachelor's degree Electrical Engineering from a Dutch HBO institution in combination with a completed bridging programme in Electrical Engineering; or

   c. Bachelor's degree in Mechanical Engineering, Aerospace Engineering and Applied Physics from Delft University of Technology, and a completed bridging programming in Electrical Engineering from TU Delft.

   Students who possess a Dutch bachelor's degree not mentioned above are required to obtain proof of admission to the programme from the dean, who will seek the advice of the admission committee on this matter.

2. **Degrees from foreign higher education institutions**

   Individuals holding a foreign bachelor's degree will be assessed on an individual basis by the admission committee.

   a. The following general selection requirements must be met:

      1) Bachelor degree in Electrical Engineering, and

      2) a minimum bachelor's Cumulative Grade Point Average (CGPA), specific requirements are defined per country (see website). If the country is not listed in the overview, the required minimum CGPA is 75%, and

      6) English language proficiency, the requirements can be found in Article 33 in the Implementation Regulations (appendix I).

   b. The following qualitative admission requirements also apply:

      1) scores for key subjects must be good,

      2) For the master's degree programme in Electrical Engineering the key subjects are defined as:

         - Mathematics (Differential Equations, Linear Algebra, Stochastics)
         - Physics (Electromagnetics, Electricity and Magnetism)
         - Electrical circuits (Electronics, Linear and Integrated Circuits)
         - Signals and Systems (Signal Processing, Systems and Control)

   c. In addition, candidates are required to submit a CVand a motivation statement.

3. **Admission to the programme 2024-2025**

   Subsection 2 of this Article applies, but additionally:

a. For EER students with an international BSc degree, a rolling admission applies with an application deadline of April 1st 2024. Enrolment is only possible per September 1st.
b. For non-EER students with an international BSc degree the application deadline is January 15th 2024. There will be a selective admission on the basis of submitted materials. Enrolment is only possible per September 1st.
c. The MSc Electrical Engineering strives for diverse and balanced student population both at programme and at track level.

Details of the application procedure and deadlines are published on the website.

Article 23A– Bridging programme for professional education graduates

1. Students with a bachelor's degree (HBO diploma) from a Dutch institute of professional education in Electrical Engineering can gain access to the Master's degree programmes in Electrical Engineering via a bridging programme.
2. Depending on the track chosen and the prior education of a student, the respective admissions committees can require additional compulsory homologation courses to be followed as part of the master's programme.
3. The bridging programme is comprised of the following study units, where the track-specific courses are compulsory for the students that will enrol in the given track:

Course code	Course name	EC
IFEEMCS011100	Calculus for Science 1	3
IFEEMCS011200	Calculus for Science 2	3
IFEEMCS011300	Calculus for Science 3	3
IFEEMCS010400	Linear Algebra	5
WI1909TH	Differentiaalvergelijkingen	3
IFEEMCS010500	Probability and Statistics	3
EE2S11	Signals and Systems	5
EE1P1	Electricity and Magnetism	5
EE2S31	Signal Processing	5
EE2S21	Systems and Control	5
EE8002	Literature Study for Electrical Engineering	2

Track specific courses			
Track	**Course code**	**Course name**	**EC**
WiCoS	EE2T11-BP	Telecommunications A Bridging Programme	3
	EE2T21	Telecommunications B	5
ME	EE3C11	Electronics	5
EPE	EE1E1	Electrical Energy Fundamentals	5
S&S	No other course required		

Article 23B– Bridging programme for research university graduates

1. Students having obtained a bachelor's degree from the following bachelor programmes of the TU Delft, TU Eindhoven or TU Twente can gain access to the Master's degree programme of Electrical Engineering (EE) via a bridging programme:
   a. Mechanical Engineering
   b. Aerospace Engineering
   c. Applied Physics
2. The bridging programme for Computer Science consists of the courses listed below.
   The following courses are compulsory:

Course code	Course name	EC
CSE2420	Digital Systems	5
EE3120TU	Guided and Wireless EM Transfer	5
EE3115TU	Digital Communication Systems	4
EE3125TU	Advanced Electronics for Robotics	5
ET3033TU	Circuit Analysis	3
ET3604LR	Electronic Circuits	3
EE2S11	Signals and Systems	5

3. If the student's prior education overlaps with courses of the bridging programme these courses may be removed from the student's bridging programme.

Article 23C – Complete Bridging programme

Students will gain access to the Master's degree programme in Electrical Engineering as described in Article 22 – Subsection 1b ,1c when they have obtained their bachelor's degree, fulfilled the language requirements of the master programme and earned a 'V' (passed) or a mark greater than or equal to 6 for all the courses in their bridging programme.

Article 24 – Goal and final attainment levels of the programme Electrical Engineering (art. 7.13 Section 2, Subsection c WHW)

1. This master's programme is intended to impart sufficient knowledge, skills and a clear understanding of the area of Electrical Engineering, in order that the graduate is able to perform independent professional and scientific activities in the area at an academic level.
2. Graduates must also meet the specific final attainment levels for this degree programme, as listed below:
   1) The electrical engineer is able to contribute their specific cognitive and intellectual skills in a multidisciplinary context for a desired external result:
      a. The electrical engineer is able to contribute their specific cognitive and intellectual skills in a multidisciplinary context for a desired external result:

b. The electrical engineer is able to identify technical-scientific and electrical engineering problems arising in professional practice, to place them in context, to formulate them and to communicate about them.
c. The electrical engineer is able to analyse electrical engineering problems and to provide suitable solutions.
d. The electrical engineer is aware of the place and the impact of their design activities in respect to the life cycle of the designed product.
e. The electrical engineer is able to report on results and methodology in the language and terminology of the professional field, both verbally and in writing.

2) The electrical engineer has a creative mind-set and has the acquisitive and intellectual skills to adapt to and function within a subfield of the professional domain:
a. The electrical engineer has insight into the nature of physics, so that they can study and understand the knowledge gained in this field, in particular as it concerns possible electrical engineering applications.
b. The electrical engineer has deductive skills, gained from the study of mathematical analysis, algebra, and the laws of probability, which enable them to analyse problems and deduce new facts.
c. The electrical engineer has in addition the capacity for lateral thinking, which enables them to achieve a set goal following other paths than those that are familiar or even well-trodden.
d. The electrical engineer has a representative knowledge of the electrical engineering disciplines and methods, with a focus on mathematical modelling and systems.
e. The electrical engineer has an operational understanding of systems engineering, the discipline that addresses the transformation of an actual market need into a schedule of demands and subsequently into an adequate system configuration through an iterative application of function analysis, synthesis, optimisation, definition, construction, testing, and evaluation.

3) The professional activities of the engineer in the area of Electrical Engineering are grounded in their personal and societal functioning:
a. The electrical engineer has insight into both their aptitude and their interests, and in the effects of their actions on societal processes, so that when making choices in their professional domain, they can assess what consequences it will have for their own and the general well-being.
b. Through their actions they will promote the societal understanding of the possibilities created by and the results of the practising of their profession.

Article 25 – General

1. The Master's degree programme in Electrical Engineering has four tracks:
    1. Wireless Communication and Sensing (WiCoS)
    2. Microelectronics (ME)
    3. Electrical Power Engineering (EPE)
    4. Signals and Systems (S&S)
2. An IEP consists of the following parts, which are described in Article 26A.

a. The programme main core of 18 credits,
b. A track core of three courses,
c. Specialisation courses worth an amount of credits required to obtain the minimum of the sum of 60 credits in combination with the main core and the track core,
d. A thesis project worth 45 credits,
e. If the total number of credits under subsection a to subsection d is lower than 120 credits the IEP should be completed with free electives to a minimum of 120 credits. Free electives should be master level courses, except that a maximum of 10 credits in the free electives can be BSc-level homologation courses.

3. The composition of the Erasmus Mundus Programme European Wind Energy Master (EWEM) elective profile in Electric Power Systems deviates and is described in Article 26B.

Article 26 – Programme details

Article 26A – Composition of the track programmes

1. The programme main core consists of the following compulsory courses:

Course code	Course name	EC
EE4C01	Profile Orientation and Academic Skills	3
EE4C11	Systems Engineering	5
And two courses chosen from the following list		
EE4C03	Statistical Digital Signal Processing and Modeling	5
EE4C04	Control System Design	5
EE4C05	Electromagnetics	5
EE4C06	Networking	5
CESE4010	Advanced Computing Systems	5
EE4C08	Measurement and Instrumentation	5
EE4C10	Analog Circuit Design Fundamentals	5
EE4C12	Machine Learning for Electrical Engineering Applications	5
EE4C13	Wireless Systems for Electrical Engineering Applications	5

2. The track core is specified by the relating track:

Wireless Communication and Sensing: select three courses from the following list		
Course code	**Course name**	**EC**
IN4341	Performance Analysis	5
EE4510	Advanced Electromagnetics	5
EE4565	Propagation and Scattering of EM Waves	5
ET4358	Fundamentals of Wireless Communications	5
ET4386	Estimation and Detection	5

Microelectronics: select three courses from the following list		
Course code	**Course name**	**EC**
EE4520	Analog CMOS design I	3
EE4585	Semiconductor Device Physics	5
EE4605	Integrated Circuits for RF/Wireless Applications	5
ET4257	Sensors and Actuators	4
ET4289	Integrated Circuits and MEMS Technology	4
EE4610	Digital IC design I	3
CESE4085	Modern Computer Architectures	5
ET4362	High Speed Digital Design for Embedded Systems	5

Electrical Power Engineering: select three courses from the following list		
Course code	**Course name**	**EC**
EE4585	Semiconductor Device Physics	5
ET4103	High Voltage Technology	4
ET4108	Transients in Power Systems	4
ET4117	Electrical Machines and Drives	4
ET4119	Electronic Power Conversion	4
ET4376	Photovoltaic Basics	4

Signals & Systems: select three courses from the following list		
Course code	**Course name**	**EC**
Compulsory		
ET4386	Estimation and Detection	5
And two courses chosen from the following list		
EE4530	Applied Convex Optimization	5
EE4595	Wavefield Imaging	5
ET4169	Radar I: From Basic Principles to Applications	5
ET4358	Fundamentals of Wireless Communications	5
EE4740	Data Compression: Entropy and Sparsity	5

3. A list of suggested specialisation courses and specialisation profiles for every track is shown in the digital Study Guide. Those courses as well as additional main core and track core courses are a-priori acceptable for the specialization space in a student's IEP, and students determine their IEP (including the specialization courses) in consultation with the signatories of their IEP (i.e., with the master coordinator and responsible professor). Note that the signatories can decide not to accept certain combinations of courses if there is too much overlap between them. Also note that it is possible to mix courses from different suggested profiles when it is accepted by the signatories of the IEP. For courses

that are NOT listed as suggested specialisation courses in the Study Guide can file a motivated request to the Board of Examiners to place such courses in the specialization space of their IEP. The request and motivation must be co-signed by the signatories of the student's IEP.

4. If a student does not have all the prior knowledge and skills required for the Master's degree in Electrical Engineering, they may include in the free elective space courses worth at most 10 credits at bachelor's level to obtain these. For subjects that are not explicitly indicated as homologation for the track approval by the Board of Examiners is required.
5. A thesis project (ET4300) worth 45 credits.
6. The free elective space may be used for courses, an internship, a project or as a thesis preparation at Industry.
   If it is an internship or an extra project there should be a clear separation between activities within the internship or extra project and within the thesis project. The assessment will take place by means of a report at the end of the internship or extra project, such that the thesis project can be clearly evaluated in isolation.

   Students from Dutch HBO programmes who have had 30 credits or more worth of work experience in their prior education, may not include the internship in their IEP[11].

Course code	Course name	EC
ET4300-I	Thesis preparation at Industry	1-15
ET4399	Extra project	3-15
EE5010	Internship	10-15
TUD4040	Joint Interdisciplinary Project	15
AP3841	Design Project	12
IFEEMCS520200	Interdisciplinary Advanced Artificial Intelligence Project	15

Up to 6 credits may be spent on language courses. These may only be chosen if required. Placement tests showing the necessity to take one or more of these courses must be taken and submitted to the master coordinator.

Language courses		
Course code	**Course name**	**EC**
WM1135TU	Advanced English for the University	3
WM1115TU	Dutch Elementary 1	3
WM1116TU	Dutch Elementary 2	3
WM1117TU	Dutch intermediate 1	3
TPM301B	Spoken English for Academic Purposes - Intermediate	2
TPM302B	Spoken English for Academic Purposes - Advanced	2
TPM303A	Intermediate Writing in English for the University	2
TPM304A	Advanced Writing in English for the University	2
TPM305A	Writing a Master's Thesis in English	2

[11] See Appendix III Transitional Regulations for possible exceptions for older cohorts.

Article 26B – Erasmus Mundus Programme European Wind Energy Master (EWEM) in Electric Power Systems

1. Students in the Erasmus Mundus Master's Programme in European Wind Energy Master (EWEM) follow the programme required by Erasmus Mundus. This programme requires that students attend three of the four partner-universities during the two years MSc programme. At least two universities must be represented by professors of the involved departments of these universities in the committee in charge of the examination of the thesis.
2. An individual study programme of students in the EWEM elective profile Electric Power Systems consists of:
    a. Core courses worth 31.5 credits
    b. Elective courses worth at least 43.5 credits
    c. The thesis project worth 45 credits
3. The courses are followed at the University of Technology Denmark (DTU) in the first semester, at Delft University of Technology (TUD) the second semester and at Norwegian University of Science and Technology (NTNU) in the third semester of the programme (first semester of the second year).
4. The complete programme is described in http://ewem.tudelft.nl/
5. A minimum of 47 credits should belong to courses from an Electrical Engineering programme.
6. Language and Communication skills (limited to between 3 and 5 credits) and an internship (limited to 6 credits) can be chosen as part of the elective space in any of the semesters at any of the participating partner universities.
7. In addition to the recommended electives, students can choose other courses from the total available list of the EWEM partner universities, in agreement with the local academic track coordinators.
8. The TU Delft Electrical Engineering degree will be awarded if a student has earned for all study units of their individual study programme of the EWEM programme at TU Delft a mark that is greater than or equal to 6 and has passed all study units of the EWEM programme at DTU and NTNU.
9. The thesis project is the final study unit of the programme and serves to prove that the student acquired the academic competences of a Master of Science. The student executes the thesis project independently, with guidance of at least two supervisors, one of them from the scientific staff of TU Delft, and one from the scientific staff of NTNU.

Part 2E – Sustainable Energy Technology

Article 27 – Admission to the Master's degree programme Sustainable Energy Technology (Art. 7.30b WHW)

1. **Degrees from Dutch higher education institutions**

   Individuals holding one of the following degrees have access to the education of the Master's degree programme in Sustainable Energy Technology on the condition that all of the stated requirements have been met.

   a. Bachelor's degree in Aerospace Engineering, Applied Earth Sciences, Applied Physics (Technische Natuurkunde), Chemical Engineering (Scheikundige Technologie), Electrical Engineering, Molecular Science & Technology, Maritime Engineering (Maritieme Techniek), or Mechanical Engineering (Werktuigbouwkunde) from Delft University of Technology, Eindhoven University of Technology, or University of Twente; or

   b. Bachelor's degree Molecular Science & Technology from Leiden University; or

   c. Bachelor's degree in Astronomy (Sterrenkunde), Physics (Natuurkunde), or Chemistry (Scheikunde) from a Dutch research university.

   Students who possess a Dutch bachelor's degree not mentioned above are required to obtain proof of admission to the programme from the dean, who will seek the advice of the admission committee on this matter.

2. **Degrees from foreign higher education institutions**

   Individuals holding a foreign bachelor's degree will be assessed on an individual basis by the admission committee.

   a. The following general selection requirements must be met:

      1) Bachelor's degree in Aerospace Engineering, Applied Earth Sciences, Applied Physics, Chemical Engineering, Electrical Engineering, Mechanical Engineering or equivalent, and

      2) A minimum bachelor's Cumulative Grade Point Average (CGPA), specific requirements are defined per country (see website). If the country is not listed in the overview, the required minimum CGPA is 75%, and

      3) English language proficiency, the requirements can be found in Article 33 in the Implementation Regulations (appendix I).

   b. The following qualitative admission requirements also apply:

      1) Academic performance in key subjects with a combined study load of at least 100 EC in engineering subjects - of which at least 80 EC in key subjects and of which minimally 20 EC in Mathematics;

      2) For the master's degree programme in Sustainable Energy Technology, the key subjects are defined as courses in these 4 areas:

         - Mathematics, minimum 20 EC;
         - Physics;
         - Chemistry;

- Electrical Engineering.

Examples of subjects in these areas and other engineering subjects can be found on the website.

c. In addition, candidates are required to submit a CV and a motivation statement.

3. **Admission to the programme 2023-2024**

Details of the application procedure and deadlines are published on the website.

In case of capacity issues, a cap may be installed on non-EER students.

Article 28 – Bridging Programme

There are no bridging programmes for Sustainable Energy Technology.

Article 29 – Goal and final attainment levels of the programme Sustainable Energy Technology (art. 7.13 Section 2, Subsection c WHW)

1. Scientific discipline

The student has knowledge and skills in disciplines of Sustainable Energy Technology and the attitude to apply these independently in the context of more advanced ideas and applications. This consists of:

a. mastery of at least three advanced subject areas within the field of Sustainable Energy Technology (such as topics in Solar Energy, Wind Energy, Waste & Combined Heat and Power, Energy Storage, Power Engineering, Electric Mobility, and Economics & Society for the track *Electrical Energy*; and topics in Heat Sources, Heat in Buildings, Large Scale Heat Systems, Waste & Combined heat and Power, Solar Energy, Power Engineering, and Economics & Society for the track *Heating and Cooling*).

b. the ability to make connections between and to integrate different subject areas within the field of Sustainable Energy Technology.

c. theoretical and practical skills to apply methods for truth-finding, theory development, modelling, interpretation, experimentation, simulation, reflection and decision making, independently.

2. Doing research

The student is able to perform research independently that contributes to the development of scientific knowledge about the application of sustainable energy technologies to address complex, energy-related problems. This consists of:

a. the ability to analyse research problems and to formulate answerable research questions.

b. practical skills and the attitude to set up and carry out research and/or draw up and implement draft plans.

c. the ability to reflect critically on the research of others and themselves, and to draw upon disciplines from other fields where necessary.

3. Designing

The student is able to create independently designs for sustainable energy technologies to address complex, energy-related problems. This consists of:

a. the ability of understanding a wide variety of different problems and to formulate these at an abstract level, whilst being able to see the relation between diverse problems at this abstract level.

   b. the capability of creating innovative technical designs, taking technical, economic and social feasibility issues into account, and with a focus on practical applications.
   c. knowledge of integration of energy technologies and of techniques to optimise the design of integrated energy systems and their parts.
   d. awareness of the applicability of research in technological developments.
4. Scientific approach

   The student has a systematic approach, characterised by the development and use of theories, models and coherent interpretations, has a critical attitude and has insight into the specific nature of science and technology related to sustainable energy technology.
5. Intellectual skills

   The student has intellectual skills befitting an academic graduate. This includes:
   a. the ability to reflect critically on their own research, thinking, and acting.
   b. the capability of formulating and defending opinions on research, design and developments in sustainable energy.
6. Co-operating and communicating

   The student is capable of working in interdisciplinary teams, performing research or design activities and communicating easily in English, both in writing and orally. This includes:
   a. exhibiting professional behaviour.
   b. the attitude and skills to perform project-based teamwork that addresses complex and interdisciplinary problems.
   c. the capability to present clearly their own research results, to communicate with colleagues and to present results at conferences or as (part of) a publication to varied audiences, while being aware of the background and interest of the audience.
7. Temporal and social context

   The student takes the consequences into account of their activities on society and vice versa. This includes:
   a. having sufficient understanding of the role of science and engineering in society to be able to reflect on this and develop an ethical attitude and practice their profession accordingly.
   b. having knowledge of economic aspects of the energy system and of policy instruments that can influence these economic aspects.
   c. having knowledge of sustainable energy-related developments in society.

Article 30A – General

1. The Master's degree programme in Sustainable Energy Technology has two tracks:
   a. Electrical Energy
   b. Heating and Cooling
2. An individual exam programme (IEP) is composed as follows:
   a. a common core worth 24 credits;
   b. a profile cluster worth 36 credits;

c. an elective space worth 15 credits and
d. a graduation project worth 45 credits.

Article 30B – 4TU character of the Master's degree programme Sustainable Energy Technology

1. The Master's degree programme in Sustainable Energy Technology is a 4TU MSc programme. The programme is offered at TU/e (Eindhoven University of Technology), TUD (Delft University of Technology) and UT (University of Twente). The programmes have similar learning objectives. The programme at each university is different. Each programme has a different Centraal Register Opleidingen Hoger Onderwijs (CROHO) registration (programme registration according to the WHW).
2. After a student is formally enrolled in the master's programme in Sustainable Energy Technology at one of the 3 universities, they will also obtain a secondary enrolment (neveninschrijving) at the 2 other universities.
3. Students are allowed to choose elective subjects from the lists of elective and core courses from each of the 3 programmes, after approval by the Board of Examiners of the home university.

Article 31 – Programme details

1. The common core courses are:

Course code	Course name	EC
SET3014	Renewable Energy	5
WM0201SET	Technical Writing	2
SET3061	Energy System Modelling	4
SET3055	Economics and Regulations of Sustainable Energy Systems	4
SET3815-M	Matlab Fundamentals	2
SET3815-Pr	System Integration Project	7

2. The profile clusters are composed of combinations of three profiles. Students follow all courses of the three profiles:

Profile clusters Electrical Energy track ↓	**Profiles →**						
	Waste & Combined Heat and Power	Power Engineering	Economics & Society	Solar Energy	Energy Storage	Wind Energy	Electric Mobility
Autonomous Systems				X	X	X	
Solar systems		X		X	X		

Waste-CHP & Solar Systems	X			X	X		
Wind & Economics		X	X			X	
Solar & Economics		X	X	X			
Waste-CHP & Economics	X		X		X		
Electric Mobility Systems		X			X		X
Electric Mobility & Economics		X	X				X

Profile clusters Heating and Cooling track ↓	**Profiles →**						
	Waste & Combined Heat and Power	Power Engineering	Economics & Society	Solar Energy	Heat Sources	Heat in Buildings	Large Scale Heat Systems
Heat Supply Systems					X	X	X
Heat Grids & Economics			X		X		X
Urban Heat & Economics			X		X	X	
Heat & Power Grids		X				X	X
Urban Heat & Electricity				X	X	X	
Industrial Heat & Electricity Integration	X		X				X

The profile courses are:

Profile 'Waste & Combined Heat and Power'		
Course code	**Course name**	**EC**
SET3070	Thermochemistry of Biomass Conversion	4
CH3061	Multiphase Reactor Engineering	4
ME45134	Process and Power Plant Design	4

Profile 'Power Engineering'		
Course code	**Course name**	**EC**
SET3095	Electronic Power Conversion	4
SET3065	Intelligent Electrical Power Grids	4
EE4545 or EE4536	Electric Power Systems of the Future or AC and DC Microgrids	4 4

Profile 'Economics and Society'		
Course code	**Course name**	**EC**
TPM0931SET	Sustainable Energy Innovations and Transitions	4
TPM0637SET	Economic Policy for Sustainable Energy	4
TPM403SET	Technology, Entrepreneurship and Sustainability	4

Profile 'Heat Sources'		
Course code	**Course name**	**EC**
SET3215	Heating and Cooling Sources	4
SET3200	Heating and Cooling Techniques from Near-Ambient Temperature Sources	4
SET3995	Direct Use of Geothermal Energy	4

Profile 'Heat in Buildings'		
Course code	**Course name**	**EC**
ME45111SET	Heating and Cooling Demand of Buildings	4
ME45075	Refrigeration and Heat Pumps Fundamentals	4
SET3220	Heat Distribution in Buildings	4

Profile 'Large Scale Heat Systems'		
Course code	**Course name**	**EC**
SET3205	Heat Storage	4
ME45165SET	Equipment for Heat & Mass Transfer	4
SET3210	Heating and Cooling Grids	4

Profile 'Solar Energy'		
Course code	**Course name**	**EC**
ET4376	Photovoltaics Basics	4
ET4377	Photovoltaics Technologies[12]	4
ET4378	Photovoltaics Systems[13]	4

Profile 'Energy Storage'		
Course code	**Course name**	**EC**
SET3080	The Necessity of Storage Technology	4
SET3110	Energy Storage in Batteries	4
SET3085	Hydrogen Technology	4

Profile 'Wind Energy'		
Course code	**Course name**	**EC**
AE4W02	Introduction to Wind Turbines: Physics and Technology	4
AE4W13	Site conditions for Wind Turbine Design	4
AE4W09	Wind Turbine Design	4

Profile 'Electric Mobility'		
Course code	**Course name**	**EC**
ET4117	Electrical Machines and Drives	4
SET3100	Electric Vehicle & Charging Technology	4
ET4291SET	Digital modelling of electric powertrain	4

3. The elective space (15 EC) should be used for one or more of the following purposes:
   a. To gain work experience (SET3822 Internship MSc SET, 15 credits). Please note: The internship has a maximum fulltime duration of three months; this includes writing the final report. The internship cannot be part of a graduation project and it is not allowed to carry out both your internship and your thesis at the same company.
   b. To gain research experience (SET4399 Extra Project, max. 15 credits).

[12] This course is part of the TU Delft MicroMasters Solar Energy Engineering.
[13] This course is part of the TU Delft MicroMasters Solar Energy Engineering.

c. To broaden knowledge of the engineering field.
d. To deepen knowledge of the SET profile (profile electives).
e. To gain entrepreneurship skills (max. 6 credits).
f. To further develop language skills (max. 3 credits). Please note: Language courses may only be chosen if required. Placement tests showing the necessity to take one or more of these courses must be taken and submitted to the Board of Examiners.

See the digital Study Guide for course options. Other courses will be taken into consideration if and when submitted to the Board of Examiners.

4. The graduation project (SET3901) is worth 45 credits. The topic of the project should fall within the chosen profile cluster, with the exception that it can fall under a fourth profile that the student has followed as part of their elective space. The supervisor for the project should be on the green list for the most relevant profile. The thesis is subject to the Rules and Regulations of the Board of Examiners of the faculty of EEMCS[14] and what is stated in Article 3 of this appendix.

[14] https://www.tudelft.nl/en/student/eemcs-student-portal/education/rules-regulations

Part 3 – Programme transitions

Article 32A – Course equivalencies

The following courses or course combinations are considered equivalent. Please note that all other changes to the IEP have to be approved by the Board of Examiners. For older course equivalencies, see Appendix II: Course Equivalencies (2021 and older)

Course no longer on offer			Equivalent course(s) on offer		
Course code	**Course name**	**EC**	**Course code**	**Course name**	**EC**
CESE4080	Quantum Computing Architecture and Electronics - Fundamentals and state-of-the-art	5	QIST4400	Quantum Computing Architecture	5
ET4399	Extra Project	1-15	SET4399	Extra Project (applies to SET)	1-15
ES5010	Thesis Project	45	CESE5010	Thesis Project	45
EE5010	Internship	15	CESE5010	CESE5010 Industry Internship	15
ET4399	Extra Project	1-15	CESE5020	CESE5020 Research Internship (applies to CESE)	10-15
CS4425	Visible Light Communication & Sensing	5	CESE4110	Visible Light Communication and Sensing	5
IN4254	Smart Phone Sensing	5	CESE4120	Smart Phone Sensing	5
IN4350	Embedded Computer Architecture 2	5	CESE4115	Embedded Computer Architecture 2	5
AP3421	Fundamentals of Quantum Information	4	QIST4310	Fundamentals of Quantum Information	4
CH3222	Energy Storage in Batteries	4	SET3110	Energy Storage in Batteries	4
TPM005A	Scientific Writing for Applied Mathematics	3	WI4800	Scientific Writing for Applied Mathematics	3
WM0931SET	Sustainable Energy Innovations	4	TPM0931SET	Sustainable Energy Innovations	4
WM0637SET	Economic Policy for Sustainable Energy	4	TPM0637SET	Economic Policy for Sustainable Energy	4

Article 32B – Transitional regulations

1. **For MSc Embedded Systems 2023-2024:**

   Per academic year 2022-2023 IN4390 Quantitative Evaluation of Embedded Systems is no longer offered. In this academic year 2023-2024 course IN4390 Quantitative Evaluation of Embedded System may be replaced by IN4341 Performance Analysis under to the following 3 conditions:

   1) Students of cohort 2021 and older wish to graduate in the old MSc ES programme;
   2) Course IN4390 Quantitative Evaluation of Embedded Systems is already in submitted IEP;
   3) Not yet successfully completed course IN4390 Quantitative Evaluation of Embedded Systems.

2. **MSc Computer and Embedded Systems Engineering (CESE) 2023-2024:**

   Starting from academic year 2023-2024 the master's programme in Embedded Systems (ES) and master's programme in Computer Engineering (CE) are merged into one master's programme, namely the master's programme in Computer and Embedded Systems Engineering (CESE).

   - Students who started the MSc ES or MSc CE programme in the academic year 2022-2023 (cohort 2022) and wish to transfer to the new merged master's programme MSc CESE as of the academic year 2023-2024, may submit a request to the Board of Examiners.
   - Students who started the MSc ES or MSc CE programme in 2021 or older (cohort 2021 and older), keep their current MSc ES and MSc CE programme. Students who have not completed all the courses of the 2021 programme and no longer have the opportunity to use the resit option, may replace the courses not yet passed with the replacement course as indicated in the replacement table (see below).
   - This transitional regulation applies until academic year 2025-2026. After the academic year 2025-2026, all MSc ES and MSc CE students of cohort 2022 or earlier must transfer to the new MSc CESE programme.

Replacement Table – MSc Computer and Embedded Systems Engineering (CESE) 2023-2024

(For cohort 2021 and older)

Courses no longer on offer			Equivalent course(s) on offer		
Course code	**Course name**	**EC**	**Course code**	**Course name**	**EC**
IN4390	Quantitative Evaluation of Embedded Systems	5	IN4341	Performance Analysis (specific conditions are described in Artikel 32B, subsection 1)	5
CESE4080	Quantum Computing Architecture and Electronics - Fundamentals and state-of-the-art	5	QIST4400	Quantum Computing Architecture	5
ES5010	Thesis Project	45	CESE5010	Thesis Project	45
EE5010	Internship	10-15	CESE5010	CESE5010 Industry Internship	10-15

ET4399	Extra Project	1-15		CESE5020	CESE5020 Research Internship (applies to CESE)	10-15
CS4425	Visible Light Communication & Sensing	5		CESE4110	Visible Light Communication and Sensing	5
IN4254	Smart Phone Sensing	5		CESE4120	Smart Phone Sensing	5
IN4350	Embedded Computer Architecture 2	5		CESE4115	Embedded Computer Architecture 2	5
EE4C07	Advanced Computing Systems	5		CESE4010	Advanced Computing Systems	5
IN4343	Real-time Systems	5		CESE4025	Real-time Systems	5
CS4140ES	Embedded Systems Laboratory	5		CESE4030	Embedded Systems Laboratory	5
ET4170	Computer Arithmetic	5		CESE4035	Computer Arithmetic	5
ET4171	Processor Design Project	5		CESE4040	Processor Design Project	5
CS4055	High-performance data networking	5		CESE4045	High-performance data networking	5
ET4285	Measuring and Simulating the Internet	5		CESE4050	Measuring and Simulating the Internet	5
ET4388	Ad-hoc Networks	5		CESE4055	Ad-hoc Networks	5
ET4394	Wireless IoT and Local Area Networks	5		CESE4060	Wireless IoT and Local Area Networks	5
IN4398	Advanced Practical I.o.T. and Seminar	5		CESE4065	Advanced Practical I.o.T. and Seminar	5
ET4310	Supercomputing for Big Data	5		CESE4075	Supercomputing for Big Data	5
EE4575	Quantum Computing Architecture and Electronics - Fundamentals and state-of-the-art	5		CESE4080	Quantum Computing Architecture and Electronics - Fundamentals and state-of-the-art	5
ET4074	Modern Computer Architectures	5		CESE4085	Modern Computer Architectures	5
ET4370	Reconfigurable Computing Design	5		CESE4090	Reconfigurable Computing Design	5
ET4272	System Design with HDLs	2		CESE4095	System Design with HDLs	2

3. For MSc Sustainable Energy Technology 2023-2024:

- From academic year 2023-2024 onwards, the course SET3311 Green Chemistry and Sustainable Technology will no longer be on offer. For students from older cohorts who did not pass the course yet, the following is applicable: the validity of the grade of the practical part will be extended to the end of academic year 2023-2024. Students can pass the course by taking the resit exams in 2023-2024. After 2023-2024, students who did not pass the course yet, will need to finish the replacement course ME45134 Process and Power Plant Design.
- From academic year 2023-2024 onwards, the course SET3013 Renewable Energy (4EC) will be changed into SET3014 Renewable Energy (5EC). Students from older cohorts who did not pass the

course yet, have two more opportunities in academic year 2023-2024 to retake the written exam for SET3013. After 2023-2024, students who did not pass the course yet, will need to finish the new version of the course SET3014 Renewable Energy (5EC) and graduate with minimum 121 EC in their exam programme.

- From academic year 2023-2024 onwards, the course SET3060 Energy System Optimization (5EC) will be changed into SET3061 Energy System Modelling (4EC). Students from older cohorts who did not pass the course SET3060 yet, will be able to pass the course by taking the exam of SET3061 and making an extra assignment for 1 EC. This is only applicable in academic years 2023-2024 and 2024-2025. If students from cohort 2022-2023 and before have not passed SET3060 by 31 August 2025, they will need to complete SET3061 as well as an extra course to make sure they graduate with an exam programme of at least 120 EC.

4. **For the joint master's programme in Computer Simulations for Science and Engineering (COSSE) 2023-2024:**
   - Students who follow the COSSE programme from 2023-2024 onwards and spend their second year in 2024-2025 at the TU Delft need to include WI5002COSSE Seminar/Literature study (15 EC) in their IEP.

5. **For MSc Applied Mathematics 2023-2024:**
   AM students from cohort 2022-2023 and before include the thesis of 42 EC in their IEP. AM students from cohort 2023-2024 and onwards include the thesis of 45 EC in their IEP.

Part 4 – Language requirements

Article 33 – Language requirements

1. **Language level for individuals holding a higher professional education degree (c)**
   a. The following candidates are exempted from the English language test requirement:
      1) Students with a bachelor's degree from a Dutch university
      2) Students with a VWO diploma or VWO English certificate
      3) Students with an HBO (University of Applied Sciences) degree from a degree programme taught entirely in English
      4) Students who hold the nationality of one of the following countries: USA, UK, Ireland, Australia, New Zealand or Canada
   b. Sufficient competence in the English language can be demonstrated by passing one of the following tests:
      1) TOEFL iBT (Test of English as a Foreign Language internet-Based Test) with an overall band score of at least 90
      2) IELTS (academic version) with an overall band score of at least 6.5
      3) Cambridge Assessment English:
         - C1 Advanced (Certificate of Advanced English) with an overall score of at least 176.
         - C2 Proficiency (Certificate of Proficiency in English) with an overall score of at least 180.
   c. If a bridging programme needs to be completed before a candidate can be admitted to a master's programme, the certificate should be obtained before the start of the bridging programme.
2. **Language level for holders of a non-Dutch diploma (d)**
   a. Competence in the English language as demonstrated by passing one of the following tests:
      1) TOEFL iBT (Test of English as a Foreign Language internet-Based Test) with an overall band score of at least 90 and a minimum score of 21 for each section
      2) IELTS (academic version) with an overall band score of at least 6.5 and a minimum score of 6,0 for each section
      3) Cambridge Assessment English:
         - C1 Advanced (Certificate of Advanced English) with an overall score of 176 and a minimum score of 169 for each section.
         - C2 Proficiency (Certificate of Proficiency in English) with an overall score of 180 and a minimum score of 169 for each section

      Certificates more than two years old will not be accepted.
   b. The following candidates are exempted from the English language test requirement:
      1) Students who hold the nationality of one of the following countries: USA, UK, Ireland, Australia, New Zealand or Canada;
      2) Students who hold a bachelor's degree from one of the above countries;

APPENDIX II. COURSE EQUIVALENCIES (2022 and older)

Appendix to Article 32A – Course equivalencies

Course no longer on offer			Equivalent course(s) on offer		
Course code	**Course name**	**EC**	**Course code**	**Course name**	**EC**
EE4C07	Advanced Computing Systems	5	CESE4010	Advanced Computing Systems	5
IN4343	Real-time Systems	5	CESE4025	Real-time Systems	5
CS4140ES	Embedded Systems Laboratory	5	CESE4030	Embedded Systems Laboratory	5
ET4170	Computer Arithmetic	5	CESE4035	Computer Arithmetic	5
ET4171	Processor Design Project	5	CESE4040	Processor Design Project	5
CS4055	High-performance data networking	5	CESE4045	High-performance data networking	5
ET4285	Measuring and Simulating the Internet	5	CESE4050	Measuring and Simulating the Internet	5
ET4388	Ad-hoc Networks	5	CESE4055	Ad-hoc Networks	5
ET4394	Wireless IoT and Local Area Networks	5	CESE4060	Wireless IoT and Local Area Networks	5
IN4398	Advanced Practical I.o.T. and Seminar	5	CESE4065	Advanced Practical I.o.T. and Seminar	5
ET4310	Supercomputing for Big Data	5	CESE4075	Supercomputing for Big Data	5
EE4575	Quantum Computing Architecture and Electronics - Fundamentals and state-of-the-art	5	CESE4080	Quantum Computing Architecture and Electronics - Fundamentals and state-of-the-art	5
ET4074	Modern Computer Architectures	5	CESE4085	Modern Computer Architectures	5
ET4370	Reconfigurable Computing Design	5	CESE4090	Reconfigurable Computing Design	5
ET4272	System Design with HDLs	2	CESE4095	System Design with HDLs	2
UT2015000042	Privacy Enhancing technologies	5	CS380	Privacy Enhancing technologies	5
IN4086-14	Data Visualization	6	IN4089	Data Visualization	5
ET4397IN	Network Security	5	CS4430	Network Security	5
EE4560	Information Theory	5	EE4740	Data Compression: Entropy and Sparsity Perspectives	5
IN4301	Advanced Algorithms	5	IN4344	Advanced Algorithms	5

ET4076-11	VLSI Test Technology & Reliability	5	EE4695	Hardware Dependability	5
EE4660	Hardware Attacks and Design for Security	5	EE4695	Hardware Dependability	5
IN4182	Digital Audio and Speech Processing	6	EE4182	Digital Audio and Speech Processing	6
IN4301	Advanced Algorithms	5	IN4344	Advanced Algorithms	5
WM0506TU	Ready to startup	6	TPM420	Ready to startup	6
WM0516TU	Turning technology into business	6	TPM416A	Turning technology into business	6
WM0638SET	Sustainable Business Venturing	4	TPM403SET	Technology Entrepreneurship and Sustainability	4
WM0903TU	Technology Entrepreneurship and Global Development	4	TPM404A	Technology Entrepreneurship and Global Development	4
EWI4020	Joint Interdisciplinary Project	15	TUD4040	Joint Interdisciplinary Project	15
CH3253SET	Thermochemistry of Biomass Conversion	4	SET3070	Thermochemistry of Biomass Conversion	4
ET4119	Electronic Power Conversion	4	SET3095	Electronic Power Conversion	4
CH3212SET	The Necessity of Storage Technology	4	SET3080	The Necessity of Storage Technology	4
CH3232SET	Hydrogen Technology	4	SET3085	Hydrogen Technology	4
CH3222SET	Energy Storage in Batteries	4	CH3222	Energy Storage in Batteries	4
CH3242SET	Fossil-Free Fuel and Feedstock	4	SET3090	Fossil-Free Fuel and Feedstock	4
AE3W02TU	Introduction to wind energy/turbine	4	AE4W02TU	Introduction to wind turbines: physics and technology	4
ET4375	Finite Element Modeling for Electrical Energy Applications	4	EE4375	Finite Element Modeling for Electrical Energy Applications	4
AP3421-D	Fundamentals of Quantum Information	4	AP3421	Fundamentals of Quantum Information	4
EE4C09	Structured Electronic Design	5	EE4109	Structured Electronic Design	5
SET3815-M SET3815-Pr	Matlab for Sustainable Energy Technology And System Integration Project	2 7	SET3815	System Integration Project	9

IN4176	Functional Genomics & Systems Biology	6		IN4176	Algorithms for network-based bioinformatics	6
IN4329	Advanced Bioinformatics	4		IN4329	Recent topics in bioinformatics	4
IN4391	Distributed Computing Systems	5		IN4391	Distributed Systems	5
CS4180	Deep Learning	6		CS4240	Deep Learning	5
IN4085	Pattern Recognition	6		CS4220	Machine Learning 1	5
IN4176	Functional Genomics & Systems Biology	6		CS4176	Algorithms for network-based bioinformatics	5
IN4329	Advanced Bioinformatics	4		CS4329	Recent topics in bioinformatics	5
MOT9610	Entrepreneurship Basic course	5		TMP401	Technology, Entrepreneurship and Innovation	5
WM0638	Sustainable Business Venturing	4		TPM403	Technology, Entrepreneurship and Sustainability	4
WM0903	Techno., Ent. Global Development	4		TPM404	Technology, Entrepreneurship and Global Development	4
MOT9556	Corporate Entrepreneurship	6		TPM406	Corporate Entrepreneurship and Startups	6
MOT9612	Business Development Lab	5		TPM411	Idea to Startup – IT & AI	5
MOT9515	CleanTech Business Study	5		TPM413	Idea to Startup – Energy & Sustainability	5
?		5		TPM414	Idea to Startup – Deep Tech	5
WM0516	Turning Technology into Business	6		TPM416	Turning technology into business	6
WM0506	Ready to Startup	6		TPM420	Ready to startup	6
WM4002	Experience Entrepreneurship	3		TPM425	Experience Entrepreneurship	3
WM4019	The Journey	6		TPM424	The Journey	6
WM0787	Patent Law and Patent Policy	5		TPM405	Patent Law and Patent Policy	5
MOT9615	Health Business Development Lab	5		TPM412	Idea to Startup – Health & Life Sciences	5
SET3012	Renewable Energy	4		SET3013	Renewable Energy	4
WB4495-09TU	Fuel Cell Systems	3		ME45100	Fuel Cell Systems	3
ET4003	Power Electromagnetics	4		EE4550	Electromagnetic Modeling in Power Engineering	5
ET4235	Statistical Signal Processing	4		EE4C03	Statistical Digital Signal Processing and Modeling	5
ET4246	Introduction Computer System Engineering	2		EE4C01	Profile Orientation and Academic Skills	3

ET4248	Introduction to Microelectronics	3		EE4C01	Profile Orientation and Academic Skills	3
ET4295	Introduction to Analog CMOS Design	4		EE4520	Analog CMOS design I	3
ET4356 (-13)	Electromagnetics	5		EE4C05	Electromagnetics	5
ET4359	Advances in Networking	5		CS4055	High-performance data networking	5
ET4385	Introduction to Telecommunications & Sensing Systems	2		EE4C01	Profile Orientation and Academic Skills	3
ET4392	Physics of Semiconductor Devices	5		EE4585	Semiconductor Device Physics	5
WI4301IN	Statistical Multivariate Data Analysis	4		CS4070-d2	Multivariate Data Analysis part 2	2.5
WI4202	Stochastic Processes	6		WI4430	Martingales, Brownian Motion and Stochastic Calculus	6
IN4340	Embedded Computer Architecture	5		ET4074	Modern Computer Architectures	5
SET3012	Renewable Energy	4		SET3013	Renewable Energy	4
WB4425-09TU	Fuel Cell Systems	3		ME45100	Fuel Cell Systems	3
SC4025	Control Theory	6		SC42015	Control Theory	6
SC4026	Control System Design	3		SC42000	Control System Design	3
SC4040	Filtering and Identification	6		SC42025	Filtering and Identification	6
SC4081-10	Knowledge Based Control Systems	4		SC42050	Knowledge Based Control Systems	4
SC4091	Optimization in Systems and Control	4		SC42055	Optimization in Systems and Control	4
SC4092	Modelling and Nonlinear Systems Theory	4		SC42060	Modelling and Nonlinear Systems Theory	4
SC4160	Modelling and Control of Hybrid Systems	3		SC42075	Modelling and Control of Hybrid Systems	3
SC4210	Vehicle Mechatronics	4		ME41110	Vehicle Mechatronics	4
WB2305	Digital Control	3		SC42095	Digital Control	3
SPM5430IA	Service Systems Engineering	4		SEN1621	I&C Service Design	5
IN4304	Empirical research methods	5		CS125	Seminar research methods for Data Science	5

ET4293	Digital IC Design	4		EE4610 and EE4615	Digital IC Design I and Digital IC Design II	3 and 3
ET4010	Wavefield Imaging	4		EE4595	Wavefield imaging	5
IN4073TU	Embedded Real Time Systems	6		CS4140ES	Embedded Systems Laboratory	5
IN4342	Embedded Systems Laboratory	5		CS4140ES	Embedded Systems Laboratory	5
SEN1511	Engineering Optimization and Integrating Renewables in Electricity Markets	5		SET3060	Energy System Optimization	5
IN4393	Computer Vision	5		CS4245	Seminar Computer Vision by Deep Learning	5
SET3041	Energy from Biomass	4		CH3253SET	Thermochemistry of biomass conversion	4
IN4320	Machine Learning	5		CS4230	Machine Learning 2	5
ET4389	Complex Networks from Nature to Man-made Networks	4		EE4389	Modeling and Data Analysis in Complex Networks	4
WI4520	Nonlinear Analysis and Partial Differential Equations	6		WI4520	Mathematics of Fluid Dynamics	6

APPENDIX III. TRANSITIONAL REGULATIONS (2022 and older)

Appendix to Article 32B – Transitional Regulations.

1. **For MSc Applied Mathematics:**
   a. In academic year 2022-2023, students from older cohorts who follow the Analysis specialisation and did not pass courses that will no longer be offered, can use the following replacements:
      - WI4645 Introduction to Quantum Information and Computing instead of WI4500 Quantum Information Technology
      - WI4655 Perturbation and Variational Methods for Partial Differential Equations instead of WI4210 Partial Differential Equations and Functional Analysis

2. **For MSc Computer Engineering**

   There are no transitional regulations for the MSc Computer Engineering.

3. **For MSc Computer Science**
   a. For academic year 2022-2023
      - In academic year 2022-2023 CS4200-B Compiler Construction B will no longer be offered. For students who have CS4200-B Compiler Construction B in their IEP, but have not yet successfully completed the course: the validity of the partial grade for the practical part (50% of the final grade) will be extended to the end of academic year 2022-2023. Students can pass the course by taking the resit exam in 2022-2023.
      - In academic year 2022-2023 CS4305TU Applied Machine Learning will no longer be offered. For students who have CS4305TU Applied Machine Learning in their IEP, but have not yet successfully completed the course: the validity of the partial grade for group assignments (50% of the final grade) will be extended to the end of academic year 2022-2023. Students can pass the course by taking the resit exam in 2022-2023.
      - In academic year 2022-2023 IN4391 Distributed Systems will no longer be offered. For students who have IN4391 Distributed Systems in their IEP, but have not yet successfully completed the course: the validity of the partial grade for practical part (40% of the final grade) will be extended to the end of academic year 2022-2023. Students can pass the course by taking the resit exam in 2022-2023.
      - In academic year 2022-2023 IN4010(-12) Artificial Intelligence Techniques (6EC) has been changed to CS4375 Artificial Intelligence Techniques (5EC). For students who have IN4010(-12) Artificial Intelligence Techniques in their IEP, but have not yet successfully completed the course: the validity of the partial grade for the practical assignments (20% of the final grade) will be extended to the end of academic year 2022-2023. Students can pass the course by taken the exam for CS4375. If the student is not successful in completing IN4010(-12) (6EC) in 2022-2023 the student must change their IEP to CS4375 (5EC).
   b. For academic year 2019-2020
      - Transitional regulation Special Programme Bioinformatics

Courses from Leiden University continue to exist and can therefore still be followed. Contact the Special Programme Coordinator for more information.

- Transitional regulation IN4320 Machine Learning

  Students of cohort 2019 and before who already have the course code IN4320 Machine Learning (5EC) in their IEP may follow CS4230 Machine Learning 2 (5EC) in 2019-2020 to receive credit for IN4320. If the student is not successful in completing IN4320 in 2019-2020 the student must change the IEP to CS4230 because the course is not available anymore. Students who do not have this course IN4320 in their IEP and have not completed IN4320 successfully must use course code CS4230 Machine Learning 2 (5EC).

- Transitional regulation IN4085 Pattern Recognition

  Students of cohort 2019 and before who already have the course code IN4085 Pattern Recognition (6EC) in their IEP may follow CS4220 Machine Learning 1 (5EC) in 2019-2020 to receive credit for IN4085. If the student is not successful in completing IN4085 in 2019-2020 the student must change the IEP to CS4220 because the course is not available anymore. Students who do not have this course IN4085 in their IEP and have not completed IN4085 successfully must use course code CS4220 Machine Learning 1 (5EC).

- Transitional regulation IN4176 Functional Genomics & Systems Biology

  IN4176 Functional Genomics & Systems Biology (6EC) has been changed to CS4176 Algorithms for network-based bioinformatics (5EC). Students who already have the course IN4176 in the IEP, but have not yet successfully completed the course, must use the new course code CS4176 and change the IEP.

- Transitional regulation IN4329 Advanced Bioinformatics

  IN4329 Advanced Bioinformatics (4EC) has been changed to CS4329 Recent topics in bioinformatics (5EC). Students who already have the course IN4329 in the IEP, but have not yet successfully completed the course, must use the new course code CS4329 and change the IEP.

4. For MSc Electrical Engineering

a. From academic year 2019 the track Telecommunications and Sensing Systems (TSS) is replaced with a new track, Wireless Communication and Sensing. From September 2019 new students will not be admitted anymore to the TSS track. All students registered for TSS at that point will be allowed to finish the track until august 2021.

5. For the joint master's programme in Computer Simulations for Science and Engineering (COSSE):

a. In academic year 2021-2022, COSSE students are allowed to follow either the new 2021-2022 curriculum or the old 2020-2021 curriculum.

6. For MSc Embedded Systems

a. Transitional regulation IN4390 Quantitative Evaluation of Embedded Systems

   Students who started their master's programme in Embedded Systems in the academic year 2018-2019 are not required to include this course in their IEP (they have to do an extra specialisation course instead). Students who started the master's programme before 2018-2019 and new students per 2019-2020, however, do have to take this course.

a. Transitional regulations MSc ES academic year 2022-2023
   - From the academic year 2022-2023 IN4390 Quantitative Evaluation of Embedded Systems will no longer be offered.
     - Students of cohort 2021 and older who have IN4390 Quantitative Evaluation of Embedded Systems in their IEP, but have not yet successfully completed the course: the validity of the grade for the practical parts will be extended to the end of academic year 2022-2023. Students can pass the course by taking the resit exams in 2022-2023.
     - Students of cohort 2021 and older who have not successfully completed the practical part of the course or have not yet taken the course, may take CS4215 Quantitative Performance Evaluation for Computing Systems as a replacement course.
   - In the academic year 2022-2023 IN4387 System Validation will not be offered. For students of cohort 2021 and older who have IN4387 System Validation in their IEP, but have not yet successfully completed the course: the validity of the partial grade for the project part (50% of the final grade) will be extended to the end of academic year 2022-2023. Students can pass the course by taking the resit exam in 2022-2023.

7. **For MSc Sustainable Energy Technology**
   a. The thesis project of the programme in Sustainable Energy Technology is also governed by the EEMCS Graduation Policy (MSc) but differs for students from cohorts before 2017-2018: these students may start the Master thesis project after completion of 45 EC of theoretical courses. This means that the industrial internship and the projects ET4380SET and SET3811 are excluded.