

# TEACHING AND EXAMINATION REGULATIONS

(TER)

(see sections 7.13 and 7.59 Higher Education and Research Act)

Master's programmes Computer Science and Telematics

Faculty of Electrical Engineering, Mathematics and Computer Science

University of Twente

**The Faculty Dean,**

*in view of sections* 9.15, first subsection, under a, 7.13, first and second subsections, 9.38, subsection b, and 9.18, first subsection, under a, of the Higher Education and Scientific Research Act of the Netherlands,

*having heard* the recommendations of the involved Education Committees, and with due observance of the consent of the involved Faculty Councils

**hereby establishes** Teaching and Examination Regulations for the Computer Science and Telematics programmes

## Remarks

These Teaching and examination regulations for the Master's programmes Computer Science and Telematics are in the format used by the 3TU.O.

Minor adaptations are underlined, or marked by a border line in the left margin (like this paragraph).

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## Section 1 – General

### *Article 1 – Definitions*

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.

The following terms are to be defined thus:

- a. the 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;
- b. the Dean: Faculty head;
- c. programme the Master's degree programme as denoted in Section 7.3a subsection 1, under b of the Act;
- d. student: anyone enrolled at the University of Twente as a student or external student for the purpose of benefiting from education and/or for the purpose of sitting the interim examinations and undergoing the degree audit which form part of the programme;
- e. subject: a unit of study within the programme as referred to in Section 7.3, subsections 2 and 3 of the Act;
- f. practical: a practical exercise as intended in Section 7.13, subsection 2, under d of the Act, taking one of the following forms:
  1. conducting a project or developing an experimental design;
  2. completing a design or research assignment;
  3. conducting a literature overview;
  4. completing a traineeship;
  5. giving a public presentation;
  6. participating in fieldwork or an excursion;
  7. conducting test and experiments;
  8. writing a position paper;
  9. participating in other educational activities aimed at enabling participants to attain certain knowledge, insights or skills.
- g. interim examination: an assessment of the student's knowledge, insight and skills in relation to a subject, as well as the marking of that assessment by at least one examiner, appointed for that purpose by the Board of Examiners;
- h. degree audit: an assessment by which the Board of Examiners, in accordance with Article 7.10 of the Act, establishes whether all interim examinations in the various subjects that constitute the Master's degree programme have been successfully completed;
- i. Board of Examiners: the programme's Board of Examiners, which has been installed in accordance with Section 7.12 of the Act;
- j. examiner: the individual who, in line with Section 7.12,

- subsection 3 of the Act, has been appointed to set the interim examinations;
- k. credit: a credit awarded in accordance with the European Credit Transfer System (ECTS); one credit denotes a study load of 28 hours;
- l. working day: Monday to Friday with the exception of recognised national public holidays;
- m. study guide: a guide to the degree programme containing specific information pertaining to the various subjects;
- n. institution: University of Twente;
- o. disability: all conditions which are (at least for the period in question) chronic or lasting in nature and which form a structural limitation for the student in receiving education and/or sitting interim examinations or taking part in practicals.

### *Article 2 – Programme composition*

1. The following points regarding the programme are included in the programme appendix:
  - a. programme composition and relevant interim examinations,
  - b. whether the programme is full-time, part-time or a sandwich course,
  - c. composition of the specializations,
  - d. study load of the programme and of each of the units of study making up that programme,
  - e. number and sequence of interim examinations and practical exercises,
  - f. whether the interim examinations will be administered in an oral, written or other format,
  - g. the content of the practicals,
  - h. if and when necessary, that a satisfactory result on an interim examination is a prerequisite for admission to other interim examinations,
  - i. if and when necessary, that the requirement to participate in a practical will be part of the admission procedure to a particular interim examination,
  - j. the units of study from which the student may choose to fulfil programme elective requirements,
  - k. the transitional regulations as referred to in article 22.
2. The programme appendix forms an integral part of these regulations.

### *Article 3 – The programme’s final attainment levels*

1. The final attainment levels of the programme are in line with the Dublin descriptors:
  - a. Knowledge and understanding:  
The graduates have demonstrated knowledge and understanding that is founded upon and extends and/or enhances that typically associated with Bachelor’s level, and that provides a basis or opportunity for originality in developing and/or applying ideas, often within a research context;
  - b. Application of knowledge and understanding:  
The graduates can apply their knowledge and understanding, and problem solving abilities in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study
  - c. Formulate judgement:  
The graduates have the ability to integrate knowledge and handle complexity, and

formulate judgements with incomplete or limited information, but that include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgements;

d. Communication:

The graduates can communicate their conclusions, and the knowledge and rationale underpinning these, to specialist and non-specialist audiences clearly and unambiguously;

e. Learning skills:

The graduates have the learning skills to allow them to continue to study in a manner that may be largely self-directed or autonomous.

2. The final attainment levels are in the programme appendix.

#### Article 4 – Admission to the programme

1. Students in possession of a diploma which shows that they have passed the final examination for the *Technische Informatica* (TU/e, TUD, UT), *Telematica* (UT), *Bedrijfsinformatietechnologie* (UT) or *Informatica* (RUG, UU, UvA, VU, UL, RU, OU) Bachelor's programme will be eligible for admission to the programmes.  
In addition, students in possession of a diploma which shows that they have passed the final examination for the *Elektrotechniek* (TU/e, TUD, UT) Bachelor's programme are eligible for admission to the Telematics programme.
2. Students who are not in possession of the diploma mentioned in paragraph 1 will require a certificate of admission issued by the Admissions Board. The Admissions Board is appointed by the Dean with the power to act in matters of admission to the programme.
3. Notwithstanding the provisions of paragraph 1, the Dean may under special circumstances admit a student to one or more interim examinations and/or practicals of the programme before the student has passed the Bachelor's examination. A limited period of validity may be set for such permission.
4. Admission of foreign students:
  - a. The student must submit a proof of sufficient command of English.  
Only the following three tests are accepted: IELTS, TOEFL internet based, and CPE.  
Scores required for admission are:  
IELTS: 6.5 or more;  
TOEFL internet based: 90 or more;  
CPE: C or higher;  
Exemption will be given by the examination board if the applicant provides a proof that his or hers previous education on secondary school and bachelor was conducted in english.
  - b. The level of education in the country in which the student has completed his/her pre-university education: this must be more or less comparable with that in the Netherlands.
  - c. Level of knowledge: the student must have accumulated sufficient knowledge on the basis of the subjects he/she has studied abroad to be at a level comparable to that of Dutch students who are admitted to the Master's programme.
5. Additional regulations for admission are in the admissions appendix.
6. The admissions appendix forms an integral part of these regulations.

## *Article 5 – Language*

1. The language of the Master’s programme is English. This applies to teaching and examination.
2. The Examination Board can grant permission to conduct interim examination in another language. Permission can be granted only if it serves the quality of the assessment.
3. Students who meet the admission requirements of article 4, but without the English language proficiency corresponding to the IELTS 6.5 level, must take English language courses to overcome their deficiency. The dean issues a regulation concerning the conditions for participation in these courses, and the faculty’s contribution in the costs of these courses.
4. The dean issues a regulation concerning the assessment of English language proficiency of staff members who teach courses in the programme, and of the support staff for the programme. All staff involved must meet the language requirements of the regulation. Courses to improve English proficiency of staff members are provided.

## **Section 2 – Interim examinations**

### *Article 6 – Number, times and frequency of interim examinations*

1. There are at least two opportunities in each academic year for sitting interim examinations.
2. A timetable of all opportunities for sitting written interim examinations is drawn up on an annual basis and details are published before the start of the academic year.
3. Notwithstanding the provisions of paragraph 1, there will be at least one opportunity in a year to sit interim examinations relating to subjects not taught in that academic year.
4. If a subject is removed from the study programme, two opportunities to sit an interim examination in this subject will be granted after the last classes in this subject have been taught: an interim examination following the last of the classes, and one resit in the same academic year. In the following academic year there will be two subsequent resits.
5. In exceptional cases, the Board of Examiners may permit a deviation from the standard number of times and the way in which certain interim examinations may be administered.

### *Article 7 – Validity of interim examinations*

1. The result of an interim examination is valid for an unlimited period.
2. However, in cases where the interim examination result dates from over six years ago, the Board of Examiners may impose an additional or substitute interim examination.

### *Article 8 – Determining and announcing the results*

1. The examiner is required to determine the result of an oral interim examination as soon as it is finished and to supply the student with a written statement of the result.
2. In the case of written interim examinations, the examiner is required to determine the result as soon as possible after the interim examination but within 15 working days at most. Taking due account of the student’s right to privacy, the student administration then ensures that the results are registered and published within 20 working days of the

interim examination date. If the examiner is unable to meet these criteria due to extenuating circumstances, the examiner must inform the Board of Examiners, stating reasons for the delay. The Board of Examiners will then pass this information on to the student or students without delay, and a new date for announcing exam results will simultaneously be made known.

3. Regarding any interim examinations that are not taken orally or in writing, the Board of Examiners will determine beforehand precisely how and within what period of time the student will be notified of the results.
4. When receiving the result of an interim examination, the student will be made aware of his or her right to inspect the results as referred to in Article 10, the opportunity for a subsequent discussion as referred to in Article 11 and the opportunity to lodge an appeal with the Examination Appeals Board.

### *Article 9 – The right to inspect the results*

1. For a period of at least 20 working days after notification of the results of any written interim examination, the student has the right to inspect his or her marked work, on request. If a student intends to lodge an appeal regarding the marking of his or her written work, he or she will be supplied with a copy of the marked work at cost price.
2. During the period referred to in paragraph 1, all interested individuals may acquaint themselves with the questions and assignments set in the interim examination in question, as well as with the criteria used for marking.
3. The Board of Examiners may determine that the right to inspection as referred to in paragraphs 1 and 2 will be exercised at a location specified beforehand and at no less than two specific times, also to be decided in advance.  
If the student can prove that he/she is or was unable to be present at the location at the set time due to circumstances beyond his or her control, then another opportunity will be provided, if possible within the period stated in paragraph 1.  
The location and times mentioned in the first sentence will be announced within five working days.

### *Article 10 – Subsequent discussion of interim examination results*

1. As soon as possible after the results of an oral interim examination have been announced, an opportunity will be arranged for the examiner to discuss the results with the student, if so requested by the student or at the instigation of the examiner. At this meeting, the reasons behind the marks awarded will be explained.
2. For a period of 20 working days after the results have been announced, students who have taken a written interim examination may submit a request to discuss the results with the relevant examiner. The discussion will take place within a reasonable time span and at a place and time determined by the examiner.
3. In cases where a collective discussion is organised by or on the instructions of the Board of Examiners, a student may only submit a request, as referred to in the preceding paragraph, 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 the student's control, the student was unable to attend the collective discussion.
4. The provisions of paragraph 3 are similarly applicable if either the Board of Examiners or

the examiner first gives the student the opportunity to compare his/her answers with model answers.

5. The Board of Examiners may permit deviations from the provisions of paragraphs 2 and 3.

## Section 3 – Studying with a disability

### *Article 11 – Adaptations to assist students with a disability*

1. Students who have a physical or sensory disability are entitled to adaptations in teaching, interim examinations and practicals. If possible, the student must submit a written request to the Dean at least three months before the student is due to participate in coursework, interim examinations and/or practicals. These adaptations will be geared as much as possible to a student's individual needs, but they must not affect the quality or the degree of difficulty of a subject or an interim examination programme. The facilities provided to this end may involve adapting the form or duration of interim examinations and/or practicals to the student's individual situation or making practical aids available. This request should be submitted to either a university student counsellor or the faculty student counsellor.
2. The request referred to in paragraph 1 should be accompanied by a recent medical certificate from a doctor or a psychologist. If there is evidence of dyslexia, for example, the request should be accompanied by a document issued by a recognised dyslexia-testing bureau (i.e. registered with BIG, NIB, or NVO). If possible, this certificate should also give an estimation of the extent of the disability.
3. The Dean will decide on requests for adaptations to the educational environment. The Board of Examiners will decide on requests for adapting interim examinations. The decision must be announced within four weeks.

## Section 4 – Approval by the Board of Examiners

### *Article 12 – Exemption from interim examinations or practicals*

1. After having been advised by the relevant examiner, the Board of Examiners may decide to exempt students from an interim examination or practical. Conditions for exemption are to be specified in the Rules and Regulations of the Board of Examiners.
2. The Board of Examiners may exempt a student from a specific interim examination only on the grounds of the content, level and quality of interim examinations successfully completed earlier or on the grounds of the student's prior knowledge, insights and skills developed outside of higher education.
3. Exemptions as referred to in Articles 13.1 and 13.2 cannot be granted on the basis of results from the Bachelor's programme, the diploma of which made the student eligible for admission.

### *Article 13 – Elective subjects*

Criteria for approval of elective subjects to be followed by the student, as referred to in the programme appendix under i, are contained in the Rules and Regulations of the Board of

Examiners.

### *Article 14 – Free programme choice*

The Board of Examiners shall decide on reasoned requests from students for free programme choice as referred to in Article 7.3c of the Act. Conditions related to this matter are to be specified in the Rules and Regulations of the Board of Examiners.

## **Section 5 – Degree audit**

### *Article 15 – The times and the frequency of the degree audit*

There shall be an opportunity to undergo the Master's degree audit at least twice a year. The dates set by the Board of Examiners are to be published before the start of the academic year.

### *Article 16 – Student support and guidance*

Responsibility for student support and guidance lies with the Dean. This includes informing students about study options within the programme or elsewhere. One or more study advisers may be appointed for this purpose.

### *Article 17 – Monitoring academic progress*

1. The Dean is responsible for the registration and timely publication of the exam results of individual students in the institution's virtual learning system.
2. The Dean is responsible for facilitating discussion of the results between the student and the study adviser, when appropriate.

## **Section 5 – Appeals and objections**

### *Article 18*

1. Decisions by the Board of Examiners based on these regulations may be appealed within four weeks after the announcement of the decision to the student in question. Appeals should be lodged with the Examination Appeals Board.
2. Decisions by the Dean based on these regulations may be appealed within six weeks after the announcement of the decision to the student in question. Objections are to be lodged with the Dean.

## **Section 6 – Contravention, changes and implementation**

### *Article 19 – Contravening the regulations*

If the study guide and/or any other regulations relating to the study programme and/or the interim examination programme prove to contravene these Regulations and the accompanying appendices, precedence will be given to the provisions of these Regulations with which the appendices form an integral whole.

### *Article 20 – Amendments to the regulations*

1. Any amendments to these regulations will be made by special resolution of the Dean.
2. No amendments will affect the current academic year unless it is reasonable to suppose that the interests of students will not be adversely affected.
3. Amendments to these regulations may not retroactively affect a decision by the Board of Examiners to the detriment of the student.

### *Article 21 – Transitional arrangements*

1. If the composition of the study programme undergoes intrinsic changes or if these regulations are amended, the Dean will draw up transitional regulations that will be incorporated in the programme appendix of these Regulations.
2. If and when appropriate, such transitional regulations are required to include:
  - a. a provision concerning the exemptions that can be given on the basis of the interim examinations already passed;
  - b. a provision specifying the validity of the transitional regulations.

### *Article 22 – Publication of the regulations*

The Teaching and Examination Regulations and the appendices, which form an integral whole with the Regulations, shall be published on the institution's website.

### *Article 23 – Entry into force*

The date of commencement of these regulations is September 1<sup>st</sup>, 2012 and replaces the regulations of September 1<sup>st</sup>, 2011.

The dean of the faculty authorizes,

*in view of* the Articles 9.5, 9.15, paragraph 1 under a, 7.13 paragraph 1 and 2, 9.38, under b, and 9.18, paragraph 1 under a, and 7.59 of the Higher Education and Research Act (WHW), and

*in due consideration* of the recommendations of the Board of Studies, as well as the approval by, or advice of, the Faculty Council.

Enschede, July 3<sup>rd</sup>, 2012



## Programme appendix to the Teaching and Examination Regulations of the Master's programmes Computer Science and Telematics

The regulations in this appendix are part of the teaching and examination regulations of the master's programmes Computer Science and Telematics of the Faculty of Electrical Engineering, Mathematics and Computer Science of the University of Twente.

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### *a. Study load*

1. The Master's degree audit for the Computer Science and Telematics programmes has a study load of 120 credits. These 120 credits must not include any credits which constituted part of a previously passed Bachelor's audit.
2. The programmes will be taught in full-time.

### *b. Composition of the programme*

1. The composition of the course programmes is as follows:
  - a. Basic subjects, 20-36 credits, as described in section c,
  - b. Advanced subjects, 18-30 credits, as described in section d,
  - c. Elective subjects, 20-45 credits, as described in section e,
  - d. Computer Ethics, 5 credits, course unit 191612680
  - d. (Research) traineeship Research topics, 15-30 credits, as described in section g,
  - e. Graduation work, 30 credits, as described in section h.
2. Each student has an individual course programme which meets the programme requirements set in sections b, c, d, e, g and h, and also the general guidelines of section i of

this appendix. Requirements vary according to

- a. the Master programme the student is enrolled in (Computer Science or Telematics);
- b. the admission of the student to graduate school programme (applies only to CSc students);
- c. the choice of a track by the student (applies only to CSc students who are not in a graduate school programme).

Details of these options are in section b sub 3 below.

3. For the composition of the course programmes this teaching and examination regulation distinguishes between 11 specializations, which are:
  1. Computer Security or Kerckhoffs (CS) Master: a Computer Science (M-CSc) specialization in Computer Security. (The course programme is organized by the Kerckhoffs Institute, a cooperation of the University of Twente with the Technical University of Eindhoven and the Radboud University at Nijmegen)
  2. Embedded Computing Systems (ECS) track . a Computer Science (M-CSc) specialization in embedded systems and/or hardware/software codesign. This specialization was discontinued and could not be entered after September 1 2010.
  3. Information Systems Engineering (ISE) track: a Computer Science (M-CSc) specialization in information systems engineering.
  4. Methods and Tools for Verification (MTV) track: a Computer Science (M-CSc) specialization in methods and tools for verification.
  5. Software Engineering (SE) track: a Computer Science (M-CSc) specialization in software engineering.
  6. Dependable and Secure Computing (DeSC) graduate school programme: this specialization is the Computer Science (M-CSc) Master part of the graduate school programme on dependable and secure computing.
  7. Service Sciences (SeSci) graduate school programme: this specialization is the Computer Science (M-CSc) Master part of the graduate school programme on services sciences.
  8. Wireless and Sensor systems (WiSe) graduate school programme: this specialization is the Computer Science (M-CSc) Master part of the graduate school programme on wireless and sensor systems.
  9. Wireless and Sensor systems (WiSe-t) track: a Computer Science (M-CSc) specialization on wireless and sensor systems. The programme is the Master part of the WiSe graduate school programme, that can be followed as a track (so independent from the graduate school).
  10. Human-Centered Interaction Technologies (HCIT) graduate school programme: this specialization is the Computer Science (M-CSc) Master part of the graduate school programme on interactions between humans and ICT (the programme is an instance of the ISE track programme).
  11. Telematics (M-TEL) Master: an independently accredited Master programme on Telematics.

4. The regulations for the choice of a specialization by the student (when applicable), and for the approval of the student's course programme (within the rules and restrictions of the programme, as outlined in this appendix) are in section i of this appendix.  
The Examination Board appoints programme mentors to advise students in their choices. Programme mentors will have the authority to approve student's programmes on behalf of the Examination Board.
5. In addition to the programme referred to in paragraph 1, students who will be admitted to the programme on the basis of a Bachelor's degree awarded by a Dutch institute of professional education (HBO) must also complete a pre-Master's programme. See the description in the admissions appendix.
6. The admissions board may issue certificates of admission with additional requirements (see the description in the admissions appendix). These additional requirements are generally called homologation courses. The obligation to take homologation courses will diminish the space the student has to take elective subjects and/or a traineeship.
7. The admissions board may issue certificates of admission with a requirements waiver. This may be the case if the student has taken relevant subjects already in his or her Bachelor's programme (see the admissions appendix). A requirements waiver increases the space the student has to take elective subjects.
8. The requirements presented in sections c through h below are modified where necessary and adopted each year by the Dean. If changes are made, a transitional arrangement is made for students (cohorts) further along in the programme, enabling them to complete their course of study in accordance with the rules. The transitional arrangements are in section q of this appendix.

### *c. Basic subjects*

1. Students must complete the basic subjects programme of their programme and specialization (see section b under 3 above). The total study load of the basic requirements is in the range of 25-36 EC, depending on the type.
2. For Computer security (Kerckhoffs) students the locations where the subjects are offered are shown in the course name. UT is the University of Twente (at Enschede), TU/e is the Technical University of Eindhoven, and RU is the Radboud University (at Nijmegen).
3. Courses marked with (\*) are excluded from the provisions of article 4 under 3 of the Teaching and Examination Regulations. Students must have a Bachelor's diploma and (or) a certificate of admission to sit the interim examination.
4. An additional recommendation applies to the Embedded Computing Systems options. The 11 units are in three different categories: Mathematics (191560810 Signals and transformations, 191560561 Introduction to mathematical systems theory, 191520751 Graph theory, 191511410 Algebra and security), Design oriented (192130122 Energy Efficient Embedded Systems, 192140122 System validation, 192170015 Testing techniques, 192620300 Performance evaluation 1), and Domain oriented (192111301 Ubiquitous computing, 192620000 Telematics networks, 191210341 Physical systems modelling of

embedded systems). It is strongly recommended that a course programme has units in each of these categories.

#### *d. Advanced subjects*

1. Students must complete the advanced subjects programme of their programme and specialization (see section b under 3 above. The total study load of the basic requirements is in the range of 18-30 EC, depending on the type.
3. For Computer security (Kerckhoffs) students the locations where the subjects are offered are shown in the course name. UT is the University of Twente (at Enschede), TU/e is the Technical University of Eindhoven, and RU is the Radboud University (at Nijmegen).
4. Courses marked with (\*) are excluded from the provisions of article 4 under 3 of the Teaching and Examination Regulations. Students must have a Bachelor's diploma and (or) a certificate of admission to sit the interim examination.
5. Kerckhoffs students choose three courses from a list of 9 options.
6. Methods and tools for verification students choose courses from two groups of options for their advanced subjects programme. They take 3 course from the 4 options in the one group and one course from the 6 options in the other group.
7. Other students (not Kerckhoffs, nor GS, nor MTV) choose courses from a group of options to a minimum study load of 20-25 EC.
8. ISE students cannot take 192110860 XML & databases 2 as an advanced course without taking 192110961 XML & databases 1, **and conversely**. An ISE student cannot take 192110890 Sensor data management 2 as an advanced course without taking 192110880 Sensor data management 1, **and conversely**. The choice for 192110961 XML & databases 1 as a basic subject, excludes the choice for the pair 192110961 XML & databases 1 and 192110860 XML & databases 2 as advanced subject. The corresponding rule also applies to the Sensor data management courses.
9. SE students cannot take 192135450 ADSA Model driven engineering as an advanced course without taking 192135400 ADSA Product line engineering, **and conversely**. An SE student cannot take 192135320 Modelling and analysis of concurrent systems 2 as an advanced course without taking 192140122 System validation as a basic subject.

#### *e. Elective subjects and homologation courses*

Elective subjects are chosen upon advice of the programme mentor. There are no formal rules limiting the choice of these subjects, except that approval of the choice of subjects by the programme mentor on behalf of the Examination Board is required.

See also section i.

In some cases the admissions board may issue a certificate of admission with additional requirements. See the admissions appendix. Generally the student will use the space for elective subjects in his or her course programme to meet these additional requirements, usually called 'homologation'. Consequently he or she can take less or no elective subjects.

### *f. Academic and Organizational Skills*

All students have to take the following course in their course programme:

191612680	Computer Ethics	5 ECTS	Mandatory
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Moreover, the student may choose 0 to 10 ECTS courses from the following list, or any other appropriate course that will help to further develop academic and organizational skills, in agreement with the programme mentor.

201000087	Entrepreneurial Finance	5 ECTS	Master Business Administration
194117020	Innovation & regulation	5 ECTS	Master Business Administration
201200009	Managing Change & Human Resources	5 ECTS	Master Business Administration
	Design in Educational Settings	5 ECTS	Master Educational Science and Technology
201000260	Advanced Science Communication	5 ECTS	Master Science Education and Communication
	Study Tour	10 ECTS	If applicable

### *g. (Research) Traineeship, research topics*

1. Graduate school students must take a 15 EC international research orientation/internship in their course programme.
2. All students except the graduate school students **may** take a 20 EC traineeship in their course programme. A student who must take homologation (see section e) courses can skip a traineeship to make space for the homologation.
3. All students, except the graduate school students **must** take a 10 EC Research topics subject in their course programme. The regulation of Article 4 under 3 does not apply to the Research topics.
4. Students may start a traineeship only if they have passed the Bachelor's audit referred to in Article 4 paragraph 1 of the Teaching and Examination Regulations. The regulation of Article

4 paragraph 3 does not apply to the traineeship.

#### *h. Graduation Work*

1. Students complete graduation work worth 30 credits.
2. Graduation work consists of a graduation project, a graduation report, a summary of the report, and a presentation. Generally the Research topics of section f above immediately precede the graduation work, and serve as a preparation for the graduation work.
3. Students may start graduation work only if they have completed all of the remaining components of the study programme. The regulation of Article 4 under 3 does not apply to the graduation project.
4. Faculty chairs take responsibility for supervision and assessment of graduation work. The division of responsibilities is as follows:

- Computer security (Kerckhoff):	DIES
- Embedded computing systems:	CAES or PS
- Information systems engineering:	IS or DB
- Methods and tools for verification:	FMT
- Software engineering students:	SE or FMT
- Dependable and Secure Computing:	DACS, DIES, FMT or SE
- Services science:	DB, IS or SE
- Wireless and sensor systems:	PS, CAES or DACS
- Human-centered interaction technologies:	HMI or DB
- Telematics:	DACS

#### *i. Course programmes*

##### **1. MSc Computer Science Track Computer Security**

###### six basic subjects:

192194100 -	Cryptography 1 (TU/e) (6 EC)
192195200 -	Security in organisations (RU) (6 EC)
192195100 -	Software security (RU) (6 EC)
192194200 -	Verification of security protocols (TU/e) (6 EC)
201100220 -	Security and Privacy in Mobile Systems (UT) (6 EC)
201000086 -	Network security for Kerckhoffs students (UT) (6 EC)

###### at least three of the following nine advanced subjects:

191210901 -	Introduction to Biometrics (UT) (6EC)
192110941 -	Secure data management (UT) (6 EC)
192195400 -	Seminar (Privacy) (RU) (6 EC)
192194110 -	Cryptography 2 (TU/e) (6 EC)
192195300 -	Hardware and operating systems security (RU) (6 EC)
192195500 -	Law in cyberspace (RU) (6 EC)

- 201100140 Hacker's Hut (TU/e) (6 EC)
- 192194400 - Seminar information security technology (TU/e) (6 EC)
- 201100221 - Cyber-crime Science (UT) (6 EC)
- 201200007 - Economics & Security (UT) (6 EC)

elective subjects:

Other subjects to obtain the minimally required number of 120 credits may be chosen from the subjects offered by other specializations.

mandatory (45 EC):

- 191612680 - Computer Ethics (5 EC)
- 192199508 - Research Topics (10 EC)
- 192199978 - Final Project (30 EC)

A special way to fulfill the requirements of Computer Security specialization is by successfully completing the course programme on SaP in the EITICT Masterschool where the second year is done at University Twente. Details on the programme are found on:

<http://eitictlabs.masterschool.eu/programme/majors/sap/>

## **2. MSc Computer Science Track Embedded Computing Systems**

3 basic subjects:

- 191210001 - Instrumentation for embedded systems
- 192130022 - Design of digital systems
- 192130112 - Distributed systems

at least 3 of the following 10 basic subjects:

- 191210341 - Physical systems modelling of embedded systems
- 191520751 - Graph Theory
- 191560561 - Introduction to mathematical system theory
- 201100109- Signals and transformations or Signalen en systemen (191561800)
- 192111301 - Ubiquitous computing
- 192130122 - Energy-efficient Embedded Systems
- 192140122 - System Validation
- 192170015 - Testing Techniques
- 192620000 - Telematics networks
- 192620300 - Performance evaluation

at least 20 ECTS of the following advanced subjects:

- 191210441 - Control Engineering
- 191210590 - Embedded signal processing
- 192111332 - Design of software architectures
- 192130092 - Faulttolerant digital systems

192130200/192130210 - Real-time systems 1/2  
 192130240/192130250 - Embedded computer architectures 1/2  
 192135310/192135320 - Modelling and analysis of concurrent systems 1/2  
 192620010 /192620020 - Mobile & Wireless Networking 1/2  
 192111233 - Aspect oriented programming  
 1921210940 - Advanced Digital signal Processing  
 1921210770 - Digital control engineering  
 1921211320 - Testable Design and  
 Test of Integrated systems  
 and  
 192199968 - traineeship (except for HBO students who have to choose at least 20 ECTS  
 more from courses listed above)

elective subjects:

Other subjects to obtain the minimally required number of 120 credits may be chosen from the subjects offered by other specializations.

mandatory (45 EC):

191612680 - Computer Ethics (5 EC)  
 192199508 - Research Topics (10 EC)  
 192199978 - Final Project (30 EC)

**3. MSc Computer Science Track Information Systems Engineering (incl. Human-centered interaction technologies)**

4 basic subjects:

192110902 - Advanced Database systems  
 192110982 - Database transactions and processes  
 192320111 - Architecture of information systems  
 192320820 - Design science methodology

at least one of the following 9 basic subjects:

201200044 - Managing Big Data  
 192110880 - Sensor Data Management 1  
 192110940 - Secure Data management  
 192110961 - XML & Databases 1  
 201100022 - Cyber-crime Science  
 192320501 - Electronic Commerce  
 192320850 - Advanced requirements engineering (start module)  
 192330301 - Specification of information systems  
 192652150 - Service-oriented architecture with web services

at least 20 ECTS of the following advanced subjects:

192110961/192110860 - XML & databases 1/2  
 192110880/192110890 - Sensor data management 1/2

192160400 -	Information retrieval
192320220 -	Advanced architecture of information systems
192320850 -	Advanced requirements engineering (follow up modules)

elective subjects:

Other subjects to obtain the minimally required number of 120 credits may be chosen from the subjects offered by other specializations.

mandatory (45 EC):

191612680 -	Computer Ethics (5 EC)
192199508 -	Research Topics (10 EC)
192199978 -	Final Project (30 EC)

**4. MSc Computer Science Track Methods and Tools Verification**

**4 basic subjects**

192111092	Advanced Logic
192135310	Modelling and Analysis of Concurrent Systems 1
192140122	System Validation
192170015	Testing Techniques

**At least three of the following basic subjects**

192135450	ADSA-Model Driven Engineering
192111233	Aspect-Oriented Programming
192130092	Fault Tolerant Digital Systems
191520751	Graph Theory
191560561	Introduction to Mathematical Systems Theory
192661001	Patterns for Software Development
201200006	Quantitative Evaluation of Embedded Systems
192620300	Performance Evaluation
191210341	Physical Systems Modelling of ES
191580251	Mathematical Programming

**advanced subjects**

192135320	Modelling and Analysis of Concurrent Systems 2
192114300	Program Verification

**At least 10 ec from the following advanced subjects**

192114100	Principles of Model Checking
192114200	Quantative Modeling and Analysis
192111700	Computability and Computational Complexity

192110280	Advanced Programming Concepts
191581420	Optimization Modelling

### Elective subjects 20 ec

#### Mandatory (45 ec)

191612680	Computer Ethics (5 EC)
192199508	Research Topics (10 EC)
192199978	Final Project (30 EC)

## 5. MSc Computer Science Track Software Engineering

#### basic subject:

192340041 -	Software management
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#### at least 25 ECTS of the following basic subjects:

191520751 -	Graph theory
191580752 -	Deterministic models in OR
192111092 -	Advanced logic
192111233 -	Aspect oriented programming
192111332 -	Design of software architectures
192140122 -	System Validation
192170015 -	Testing Techniques
192320820 -	Design science methodology
192330301 -	Specification of information systems

#### at least 20 ECTS of the following advanced subjects:

192110280 -	Advanced programming concepts
192135310 -	Modelling and analysis of concurrent systems 1
192135320 -	Modelling and analysis of concurrent systems 2
192135400 -	ADSA-Product Line Engineering
192135450 -	ADSA-Model Driven Engineering
192320850 -	Advanced requirements engineering

#### elective subjects

Other subjects to obtain the minimally required number of 120 credits may be chosen from the subjects offered by other specializations.

#### mandatory (45 EC):

191612680 -	Computer Ethics (5 EC)
192199508 -	Research Topics (10 EC)
192199978 -	Final Project (30 EC)

## 6. Graduate School Programme Dependable and Secure Computing

### compulsory core courses (25 EC):

192130092 -	Faulttolerant Digital Systems
192140122 -	System Validation
192194200 -	Verification of Security Protocols (TU/e, 6EC)
192111332 -	Design of Software Architectures
191210341	Physical Systems Modelling of Embedded Systems

### and depending on choice of track (30 EC):

#### ***Track Dependability Modeling and Evaluation (DME):***

192135310 -	Modeling and Analysis of Concurrent Systems 1
192135320 -	Modeling and Analysis of Concurrent Systems 2
192114200 -	Quantitative Modeling and Analysis
192135450 -	ADSA Model Driven Engineering
191580752 -	Deterministic Models of OR
201200006 -	Quantitative Evaluation of Embedded Systems

#### ***Track Secure Networks (SN):***

192654000 -	Network Security
1921109410 -	Secure Data Management
192620010 -	Mobile and Wireless Networking 1
192194100 -	Cryptography 1 (TU/e) (6EC)
201100022 -	Cyber-crime Science
192130300 -	Performance Evaluation

#### ***Track Dependable Software Synthesis (DSS):***

192661001 -	Patterns of Software Development
192111233 -	Aspect Oriented Programming
192170015 -	Testing Techniques
192135450 -	ADSA Model Driven Engineering
192114300 -	Program Verification
192135310 -	Modeling and Analysis of Concurrent Systems 1

### elective courses (15 EC):

These consist of:

- courses in the other tracks of “Dependable and Secure Computing”
- courses from the following list
- other courses in consultation with the programme mentor

listed courses:

192111092 -	Advanced Logic (FMT)
192110280 -	Advanced Programming Concepts (SE)
192111700 -	Computability and Computational complexity (HMI)
191210441	Control Engineering
192130112 -	Distributed systems (PS)
191520751 -	Graph Theory (DMMP)
192653100 -	Internet Management and Measurement (DACs)
191210900 -	Introduction to Biometrics (SAS)
191560561 -	Introduction to Mathematical Systems Theory (MSCT)
192140700 -	The Numbers tell the Tale
192620020 -	Mobile and Wireless Networking 2 (DACs)
191211090 -	Real-Time Software Development (EL)
192620000 -	Telematics Networks (DACs)
191211080 -	Systems Engineering (EL)

mandatory (50 EC):

- 191612680 Computer Ethics
- International Research Orientation/Internship (15 EC)
- Master Thesis (including Research Proposal) (30 EC)

## **7. Graduate School Programme Service Sciences**

four compulsory courses:

192320111 -	Architecture of Information Systems
192110902 -	Advanced Database Systems
192320501 -	Electronic Commerce
192111332 -	Design of Software Architecture

four courses in Track A: Services technologies:

192652150 -	Service-Oriented Architecture with Web Services
192110982 -	Database Transactions and Processes
192330301 -	Specification of Information Systems
192135450 -	ADSA- Model Driven Engineering
192110961 -	XML & Databases 1

five courses in Track B: Services in business:

192376500 -	Business Process Integration Lab
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193160060 - Information & Knowledge Exchange Services  
194108040 - Business Development in Networks  
192320201 - Data Warehousing & Data Mining  
192320820 - Design Science Methodology

four elective courses:

- a. Compulsory courses from the other tracks.
- b. Courses from the following list:

192320220 - Advanced Architecture of Information Systems  
192320850 - Advanced Requirements Engineering  
192376000 - Business Case Development for IT-projects  
192340070 - Computer Supported Cooperative Work  
192404600 - E-Government: communication and organization  
192350200 - E-Strategizing  
192360021 - ICT Management  
192340101 - Implementation of IT in Organizations  
194105070 - Information Systems for the Financial Services Industry  
193163010 - Information and Knowledge Management  
191863970 - Information Systems Design Methodologies

193190000 - Managing Service Organizations  
192631000 - Mobile E-health Applications and Services  
191852640 - Production & Logistics Information Systems  
201100022 - Cyber-crime Science  
192330301 - Specification of Information Systems  
195810200 - Supply Chain Management & ICT  
192140122 - System Validation  
192110961 - XML & Databases 1

mandatory (55 EC):

- Individual specialization assignment for Track A or B (5 EC)
- 191612680 Computer Ethics (5 EC)
- 201100203 Research Orientation (15 EC)
- Master thesis (including research proposal) (30 EC)

**8/9. MSc Computer Science Track/ Graduate School Programme Wireless and Sensor Systems**

basic homologation courses for bachelor TI (10 EC):

192110001 - Instrumentation for Embedded Systems (5 EC)  
191561800 - Signals and Systems (5 EC)

basic homologation courses for bachelor EE (10 EC):

- 192135050 - Programming 2 (5 EC)
- 192110452 - Operating Systems (5 EC)

basic homologation courses for bachelor CT (10 EC):

- 192131102 - Computer Organisation (5 EC)
- 192110542 - Computer Systems (5 EC)
- 192110452 - Operating Systems (5 EC)

basic courses (at least three of the following, so 15 EC total):

- 192620010 - Mobile and Wireless Networking I (5 EC)
- 201000075 - Wireless Sensor Networks (5 EC)
- 191211590 - System-on-Chip for ES (5 EC)
- 192111301 - Ubiquitous Computing (5 EC)

basic elective courses (20 EC):

- 192130112 - Distributed Systems (5 EC)
- 191211030 - Mobile Radio Communications (5 EC)
- 192620300 - Performance Evaluation (5 EC)
- 192620020 - Mobile and Wireless Networking II (5 EC)
- 191210590 - Embedded Signal Processing (6 EC)
- 192110880 - Sensor Data Management (5 EC)
- 191211650 - MDDP (5 EC)
- 201100072 - Introduction to Information Security (5 EC)

elective courses (minimal 10 EC):

Other subjects to obtain the minimally required number of 120 credits may be chosen from the subjects offered by other specializations in masterprogramme's of Computer Science, Electrical Engineering, Telematics and Embedded Systems.

mandatory (65 EC):

- 191211749 - Individual Project (10 EC)
- 191612680 - Computer Ethics (5 EC)
- 191211208 - International research orientation or internship (20 EC)  
(not for HBO students)
- 192199978 - Final Project (30 EC)

**10. Graduate School Programme Human-centered interaction technologies (included in 3)**

A special way to fulfill the requirements of HCID specialization is by successfully completing the course programme on HCID in the EITICT Masterschool where the second year is done at University Twente. Details on the programme are found on:

<http://eitictlabs.masterschool.eu/programme/majors/hcid/>

## **11. Master of Science Telematics**

### 4 core courses (20 EC):

- 192620010 - Mobile and wireless networking 1
- 192620300 - Performance evaluation
- 192652150 - Service oriented architecture with web services
- 192654000 - Network security

at least 1 (min. 5 EC) of the following advanced courses on modelling and validation:

- 201200006 - Quantitative Evaluation of Embedded Systems
- 192140122 - System validation
- 192170015 - Testing techniques

at least 2 (min 10 EC) of the following advanced courses on networking technologies:

- 191211710 - Core networks
- 192620020 - Mobile and wireless networking 2
- 192620250 - Selected topics in P2P systems
- 192653100 - Internet management and measurement

zero or more advanced courses chosen from the following list, such that the advanced courses in total (i.e., including the ones chosen from the above two lists) are at least 30 EC:

- 191210780 - Modern Communication Systems
- 191210800 - Information Theory
- 191211030 - Mobile radio communications
- 192110880 - Sensor data management 1
- 192111301 - Ubiquitous computing
- 192114200 - Quantitative Modeling and Analysis
- 192135450 - ADSA Model Driven Engineering
- 192140700 - The numbers tell the tale (meten = weten)
- 201100140 - Hacker's Hut
- 192195200 - Security in organisations
- 192320111 - Architecture of information services
- 192631000 - Mobile e-health applications and services
- 192661001 - Patterns of software development

### elective subjects (min. 25 EC)

Other courses to obtain the minimally required number of 120 credits may be chosen from the courses offered by the university, subject to approval by the programme mentor.

An internship of 20 EC may be part of this.

### mandatory (45 EC):

191612680 -	Computer Ethics (5 EC)
192199508 -	Research Topics (10 EC)
192199978 -	Final Project (30 EC)

## *j. Course programme approval*

### **Approval procedures**

The student must complete the following steps to obtain course programme approval:

#### 1. Orientation

Students complete subjects and sit interim examinations as they see fit. In this phase only a few credits can be earned. During this phase, the student can be advised by the admissions board or, if the choice of track is clear, by a programme mentor (see section b under 3). If the student chooses subjects or projects during orientation without consultation of the admissions board or a programme mentor, he/she does so at his/her own risk.

If 15 credits have been earned in the Master's Programme, the orientation ends. At this point, permission from a study adviser is required for a more complete programme of at least one year. Phase 2 begins.

In case the student during orientation chooses only subjects and projects which are mandatory for any course programme (within a given graduation subject field or track), consultation with and approval by a programme mentor may be postponed to a maximum of 30 credits. No one can earn more than 30 credits in phase 1.

#### 2. Approval of initial choices

After receiving approval from the programme mentor, at least 60 credits of the course programme to be completed or already partially completed are laid down. The choice of graduation subject field or track is clear, as is the matter of whether a traineeship will be included in the course programme. The manner in which the credits for optional units of study are to be allocated and the chair/chairs from which the student will graduate may still be not entirely clear.

#### 3. Approval of entire course programme

The programme mentor approves the 120-credit course programme in its entirety. At this point it is clear which chair/chairs will bear responsibility for the student's graduation supervision.

Students may reduce the term of Phase 1 and skip Phase 2. Regardless of how the student wishes to proceed, once the limit established for the orientation phase has been reached (i.e.

15 programme credits earned or 30 credits for mandatory units of study only), the study adviser must be contacted.

#### Laying down and obtaining approval of course programmes

Standard forms for laying down the course programme are available from the Educational support office secretariat and on the website of the Faculty of EEMCS.

Once the programme and student reach an agreement on the content of the course programme, they complete and sign the forms. The programme mentor signs on behalf of the Examination Board.

The completed and signed form listing the course programme must be included in the student's file at S&O (the Student & Education service centre).

In principle, the student will earn the programme diploma if he/she completes the units of study listed in the course programme and earns results in line with the guidelines for passing the final assessment.

If the course programme listed on a signed form does not satisfy the regulations described in this programme appendix and/or does not satisfy the conditions imposed by the admissions board, the Examination Board is authorised to impose additional diploma eligibility requirements.

#### General guidelines for the composition of course programmes

There are six general rules to be observed by the student and study adviser in assessing the student's possible course programme choices and in signing the finalized course programme. These general rules work differently according to programme, graduation subject field and track. See also sections b-h of this appendix

1. The student creates a programme of units of study totalling 120 credits. These units are selected from among the courses offered by the UT or, where beneficial, courses offered by other universities. All course programmes except for graduate school students **have to include Computer Ethics (191612680, 5 credits), a 30-credit graduation assignment, and a 10-credit research project**. Graduate school students have to include Computer Ethics (191612680, 5 credits), a 15 credit international research orientation/internship and a 30 credit graduation assignment. The Examination Board may grant a student (not a graduate school student) exemption from the mandatory 5 credits Computer Ethics and/or the 10 credits research project.

2. The admissions board may grant a student admission with additional requirements, imposing additional diploma eligibility requirements. These requirements differ from student to student. No more than 30 credits will be required to satisfy the conditions imposed by the admissions board.

The Master's programme final assessment cannot be passed if the course programme of this category of students does not satisfy the additional requirements imposed. There are no exceptions to this rule.

3. Requirements apply to each course programme to ensure basic knowledge in the field of study and the track selected. The admissions board may adjust these requirements on the basis of the student's prior education and training. Such an adjustment will never entail an

intensification of the requirements. The Master's programme final assessment cannot be passed if the course programme does not satisfy the basic knowledge requirements. The only exception to this rule is when the admissions board lowers the basic knowledge requirements.

4. Requirements apply to each course programme to ensure sufficient depth of study in the track selected. The manner in which these requirements are satisfied is determined in consultation with the study adviser. This includes, where necessary, taking into account which chair/chairs will bear responsibility for the student's graduation supervision. The Master's programme final assessment cannot be passed if the course programme does not satisfy the depth of study requirements. There are no exceptions to this rule.
5. Requirements apply to some course programmes governing the chair from which the student can complete his/her studies, according to the graduation subject field or track selected. The Master's programme final assessment cannot be passed if, during the course of study, the requirements for the composition of the graduation committee are not satisfied. There are no exceptions to this rule.
6. One guideline applicable to all course programmes is that continuing students (i.e. holders of a UT Bachelor's diploma eligible for automatic admission to one of the Master's programmes) complete part of the programme's 120 credits **outside** of the UT. The Examination Board may decide to exempt an individual from this guideline.

The total number of credits completed **at the UT or at another university or research institute approved by the study adviser, must be at least 90**. The Examination Board may permit a student to deviate from this rule. Additional requirements with regard to the type of activities completed by students outside of the UT may be posed. For instance, the obligation that a student complete a traineeship. Such a requirement must involve no more than 30 credits. The Master's programme final assessment cannot be passed if the course programme does not satisfy the requirements imposed with regard to the units of study completed outside of the UT, unless an exemption has been granted.

#### *k. Free programme*

1. Students can compile their own programme, with an associated degree audit. The programme requires prior approval by the Board of Examiners. The Board of Examiners draws up a regulation for approval of free programmes.
2. When applying to the Board of Examiners for the prior approval referred to in paragraph 1, students must provide details of their reasons for making this request.

#### *l. Earning two diploma's with a single (extended) programme*

In some cases, a student can take the final assessment for two Master's programmes on the basis of a combined course programme satisfying the requirements of each individual programme.

The following conditions must be met to be eligible for a combined final assessment:

#### Composition of a combined programme

1. The student's course programme can be described as the amalgamation of two (not necessarily) disjunctive) course programmes satisfying the requirements of both programmes.
2. The two sub-course programmes referred to in 1. Have no more than 30 credits in common outside of a possible combined graduation assignment. This not only includes units of study included in both course programmes, but also units of study for which an exemption was granted for one course programme on the basis of a result earned as part of the other course programme.
3. If a single graduation assignment is included in the intersection of both course programmes as referred to in 1., the assignment must involve an exceptional study load, equalling at least 75% of the combined study load of two individual graduation assignments (one for each programme).

#### Passing the final assessment for a combined programme

Students who based in a course programme as described above sit a combined final assessment will successfully pass if the assessments included in the file would result in passing the final assessment of both programmes individually in accordance with the applicable regulations. The Examination Boards of the programmes involved must decide to allow a student to pass the final assessment.

#### *m. Organisation of practicals*

There are no specific regulations for the organisation of practicals.

#### *n. The order of and the conditions for admission to units of study, interim examinations and practicals.*

To participate in a unit of study the student it is mandatory for a student to register as a participant. Registration is possible in the periods published in the rosters. To sit (interim) examinations, registration is mandatory also. Periods for registration are published in the roster. Admission to units of study and interim examinations can be denied to students who did not register.

Additional conditions of admission to the units of study and to interim examinations are in sections g (for traineeship) and h (for graduation work).

#### *o. The final attainment levels of the programmes*

1. The degree programmes have the following general scientific attainment levels
  - a. Graduates have an extensive knowledge of and understand the issues relevant to their specific field of study (i.e. programme-specific attainment targets) described in section l of this appendix under 2 below.
  - b. Graduates can contribute to scientific research, and independently design, conduct and

- present the results of small-scale research.
- c. Graduates can provide an original contribution to the development and/or application of the field of study. 'Original' is understood to mean 'demonstrative of a creative contribution'.
  - d. Graduates can analyse complex problems (change problems) relevant to the field of study and obtain the required knowledge and information.
  - e. Graduates can design, validate and implement solutions/systems in their operational context; identify and apply relevant advanced knowledge, methods and techniques from their field of study.
  - f. Graduates can assess solutions/systems and their applications according to their properties and potential to solve problems even if they are new to or unfamiliar with the situation or lack information and/or reliable information; they can use their assessment as a basis for (substantiation of) decisions.
  - g. Graduates understand the ethical, social, cultural and public aspects of problems and solutions in their field of study; apply this insight in their international role as scholar.
  - h. Graduates can work as part of and play a leading role in a team; manage and plan a development process; document development and research processes.
  - i. Graduates can substantiate research results, designs and applications in writing and verbally; critically assess and participate in debates regarding the same.
  - j. Graduates can independently acquire new knowledge and skills; reflect on trends in their field of study, responsibilities and roles and use this insight as a guide for and integrate it into their own personal development.
  - k. Graduates can integrate information from other disciplines into their own work if necessary.
  - l. Graduates take a critical approach to reading, incorporating information presented in and participating in debates regarding international scientific literature relevant to their field of study.

#### *p. Assessment and marking*

Tables 3 show how assessments for the units of study are organised.

The 'Assessment method' columns use the following codes:

- |     |   |
|-----|---|
| S   | written interim examination   |
| O   | written assignment: detailed exercises, a report, an essay or other written document reviewed and assessed by the examiner, but not in the presence of the student  |
| M   | oral assessment: a meeting involving the student and the examiner or other individual, during which the student's knowledge is assessed   |
| P   | practical assignment: a functioning product prepared and submitted by the student to be assessed in terms of behaviour, operation and/or use (e.g. a simple programme or a larger, functioning prototype) |
| Pj  | project: group activities as part of which the resulting group work and the student's participation are assessed  |
| Pre | presentation: information presented by the student before an audience, usually other students   |

These codes are used to give a general indication of the assessment method of each unit of study, not outline the exact rules governing the form of assessment.

Table 3

The numbers in the Prerequisites column are explained at the end of the table.

Course	Study load	Assessment	Pre-requisites	Additional regulations
191210001 Instrumentation for embedded systems	5	S		
191210341 Physical systems modelling of embedded systems	5	S		
191210441 Control engineering	5	S or O		
191210590 Embedded signal processing.	5	S, P, Pj		
191210780 Modern Communication Systems	5	O, Pre	1	
191210900 Introduction to biometrics (UT)	5	O		
191211030 Mobile radio communication	5	O, Pre		
191211710 Core networks	5	S, O, Pre		
191511410 Algebra & Security	5	S		
191520751 Graph theory	5	S		
191560561 Introduction to mathematical system theory	5	S, P, O		
201100109 Signals and transformations	5	S		
191580752 Deterministic models	5	S		

in OR			
192130092 Fault tolerant Digital Systems	5	S	
192110280 Advanced programming concepts	5	S, O, Pre	
201200044 Managing Big Data	5	O	
201000086 Network Security for Kerckhoffs students	6	S, O, P	
192110941 Secure Data Management	6	S, O	
192110860 XML & databases 2	5	O	To have 192110860 in his course programme, the student must also take 192110961
192110880 Sensor Data Management 1	5	S, O	
192110890 Sensor data management 2	5	Pj	To have 192110890 in his course programme, the student must also take 192110880
192110902 Advanced database systems	5	S, P	
192110940 Secure data management	5	S, O	
192110961 XML & Databases 1	5	S, O	
192110982 Database transactions and processes	5	S, O	
192111092 Advanced logic	5	S, O	
192111233 Aspect oriented programming	5	O, P	
192111301 Ubiquitous computing	5	O, Pre	
192111332 Design of software architectures	5	S, O	
192111700 Computability and computational complexity	5	S	
192114100 Principles of model	5	S	

checking		
192114200 Quantitative modelling and analysis	5	O
192114300 Program verification	5	S, O
192130022 Design of digital systems	5	Pj
192130092 Faulttolerant digital systems	5	S
192130112 Distributed systems	5	S
192130122 Energy- efficient Embedded Systems	5	O, Pre
192130200 Real-time systems 1	5	S
192130210 Real-time systems 2	5	S, O
192130240 Embedded computer architectures 1	5	S, Pj
192130250 Embedded computer architectures 2	5	S
192135310 Modelling and analysis of concurrent systems 1	5	O
192135320 Modelling and analysis of concurrent systems 2	5	S, Pj
192135400 ADSA Product line engineering	5	S, O, Pre
192135450 ADSA Model driven engineering	5	S, O, Pre
192140122 System validation	5	S, O
192140700 The numbers tell the tale (meten = weten)	5	O
192150201 Distributed Trust Management	5	S, O
192150300 Security of information services	5	S
192160400 Information retrieval	10	S, O
192170015 Testing techniques	5	S, P
192194100 Cryptography 1	6	S

(TU/e)

192194110 Cryptography 2  
(TU/e) 6 S, O

6 O

192194200 Verification of  
security protocols (TU/e)

192194300 Linux kernel and  
hacker's hut (TU/e) 6 O

192194400 Seminar information  
security technology (TU/e) 6 O, Pre

192195100 Software security  
(RU) 6

192195200 Security in  
organisations (RU) 6

201100022 Cyber-crime Science 5 S

201100221 Cyber-crime Science 6 S

201100023 Security and Privacy  
in Mobile Systems 5 S

201100220 Security and Privacy  
in Mobile Systems 6 S

201200007 Economics &  
Security 6 S

192195300 Hardware and  
operating systems security (RU)

192195400 Seminar (Privacy)  
(RU) 6 O, Pre

192195500 Law in cyberspace  
(RU) 6

192320111 Architecture of  
information systems 5 M or S

192320220 Advanced  
architecture of information  
systems 10 O

192320501 Electronic commerce 5 S, Pj

192320820 Design science 5 M or S

methodology		
192320850 Advanced requirements engineering	10	M or S
192330301 Specification of information system	5	S, P
192340041 Software management	5	M or S, O
192620000 Telematics networks	5	S, P
192620010 Mobile and wireless networking 1	5	S
192620020 Mobile and wireless networking 2	5	S, Pre
192620250 Selected topics in P2P systems	5	S, O, Pre
192620300 Performance evaluation 1	5	S, O
192631000 Mobile e-health applications and services	5	Pj
192652150 Service-oriented architecture with web services	5	S, O
192653100 Internet management and measurement	5	O
192654000 Network security	5	S, O, P
192661001 Patterns of software development	5	O

1. Students are eligible for this course only if they have taken two bachelor's courses: 1 Inleiding Telecommunicatie (191210091) and Inleiding Communicatiesystemen (191251530)

#### *q. Transitional arrangements*

1. Regulation 2009-2010 for ISE and TEL students.  
Occasion: This regulation is necessary because 192110830 Advanced distributed multi-media database systems 1 and 192110840 Advanced distributed multi-media database systems 2 are no longer offered in the academic year 2009-2010.

**Term of validity:** until September 1, 2013.

**Contents of the regulation:** Under conditions given below, 192110830 Advanced distributed multi-media database systems 1 is a valid substitute for the basics programme option 192110880 Sensor data management 1. Under the same conditions the combination of 192110830 Advanced distributed multi-media database systems 1 and 192110840 Advanced distributed multi-media database systems 2 is a valid substitute for the combined advanced subjects options 192110880 Sensor data management and 1192110890 Sensor data management 2.

The conditions for substitution are:

- The course programme is approved before 1 January 2010, and
- the results for the substitute (old) units are obtained before 1 September 2010.

2. Regulation 2010-2011 regarding Embedded Computing Systems specialization  
Occasion: This regulation is necessary because the track Embedded Computing Systems is discontinued starting from September 1, 2010.

**Term of validity:** until September 1, 2014.

**Contents of the regulation** Students who have their course programme approved before September 2010 can still finish this specialization.

3. Regulation 2010-2011 regarding Computer Ethics  
Occasion: This regulation is necessary because Computer Ethics (191612680, 5 EC) is a mandatory item in the course programmes of all M-CSc and TEL students, starting 1 September 2010.

**Term of validity:** until September 1, 2014.

**Contents of the regulation:** Students who have their course programme approved before 1 September 2010 can take the degree without Computer Ethics as a unit in their programme. Programmes submitted for approval after 1 September 2010, must contain Computer Ethics (191612680, 5 EC) as a unit.

4. Regulation 2011-2012 regarding MTV  
The requirements w.r.t. the programme of the specialization MTV are changed per 1 september 2012. Students who have their course programme approved before 1 september 2012 can take the degree based on that approved programme.

5. Regulation 2011-2012 regarding DECS  
The requirements w.r.t. the programme of the specialization DECS are changed per 1 september 2012. Students who have their course programme approved before 1 september 2012 can take the degree based on that approved programme.

6. Regulation 2011-2012 regarding removal of courses, changed courses and new courses

#### **New courses**

Cyber-crime Science	5 ec.	201100022	(M-CSc)
Cyber-crime Science for Kerckhoff	6 ec.	201100221	(M-CSc)

Security & Privacy in Mobile Systems	5 ec.	201100023	(M-CSc)
Security & Privacy in Mobile Systems for Kerckhoff	6 ec.	201100220	(M-CSc)
Economics & Security	6 ec.	201200007	(M-CSc)

### Changed courses

Quantitative Evaluation of Embedded Systems 201200006 (M-CSc/M-TEL)  
 (used to be Performance Analysis / 192130500)

Managing Big Data 201200044 (M-CSc)  
 (used to be Distributed Data Processing Using MapReduce/192110720)

Signalen & Transformaties 201100109 (M-CSc)  
 (course is now offered in 1B instead of 1 A and formerly had code 191560810)

### 7. Regulation 2012-2013 regarding programme changes

Occasion: This regulation is necessary because of several small changes (shifting of courses, changes in EC) in some specialization programmes.

**Term of validity:** until September 1, 2015.

**Contents of the regulation:** Students who have their course programme approved before 1 September 2012 and whose course programme is affected by changes should contact their programme mentor for an appropriate solution.

## **Admissions appendix to the Teaching and Examination Regulations of the Master's programmes Computer Science and Telematics**

The regulations in this appendix are part of the teaching and examination regulations of the Master's programmes Computer Science and Telematics of the Faculty of Electrical Engineering, Mathematics and Computer Science of the University of Twente.

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### **Admission**

Enrolment as a student is required to sit interim examinations and to be eligible to earn the Master's diploma. In order to be enrolled, students must demonstrate that they have been admitted to one of the Master's programmes.

Admission involves an assessment of the student's eligibility for the Master's programme of his/her choice. The Dean has appointed the admissions board with the power to determine admissibility. If the admissions board positively assesses an application for admission, it issues a certificate of admission. Students with a certificate of admission are eligible for enrolment by the Central Student Administration. Enrolment will only take place if the other admission requirements maintained by the UT have also been satisfied.

### **Admission pursuant to a regulation**

The Teaching and Examination Regulation stipulates that certain groups of students are eligible for admission. (Article 4.1).

1. Students in possession of a diploma which shows that they have passed the final examination for the *Technische Informatica* (TU/e, TUD, UT), *Telematica* (UT) or *Informatica* (RUG, UU, UvA, VU, UL, RU, OU) Bachelor's programme will be eligible for admission to the programmes.

In addition to these provisions from the Teaching and Examination Regulation, the Dean has adopted the following provisions:

1. Applicants who satisfy the following three requirements are eligible for admission to the CS Master's programme.

- a. The applicant is holder of a diploma from Saxion Hogeschool Enschede or Hogeschool Windesheim Zwolle) demonstrating that he or she has satisfied the requirements of the final assessment of the Computer Science (Informatica) Bachelor's programme or the Technical Computer Science (Technische informatica) Bachelor's programme
  - b. The applicant has successfully completed the DOORSTROOMMINOR as part of his or her bachelor's course programme
  - c. The applicant, according to UT records, has sat the interim examination of either the subject 214025 ADC plus or the subject 214020 ADC while completing the Advanced Algorithms elective module and received a mark of 6, 7, 8, 9 or 10 or, if no mark is awarded, 'pass' ('G' in Dutch)
2. Applicants who satisfy the following requirements are eligible for admission to the CSc Master's programme.
- a. The applicant is holder of a diploma from the University of Twente demonstrating that he or she has satisfied the requirements of the final assessment of the Advanced Technology Bachelor's programme.
  - b. The applicant has successfully completed the following electives as part of his or her bachelor's course programme
    - 192135000 - Programmeren 1
    - 192135050 - Programmeren 2
    - 192110741 - Gegevensbanken
    - 192140250 - Algoritmen, Datastructuren en Complexiteit plus
    - 192110452 - Besturingssystemen
3. Applicants who satisfy the following requirements are eligible for admission to the TEL Master's programme.
- a. The applicant is holder of a diploma from the University of Twente demonstrating that he or she has satisfied the requirements of the final assessment of the Advanced Technology Bachelor's programme.
  - b. The applicant has successfully completed the following electives as part of his or her bachelor's course programme
    - 192135000 - Programmeren 1
    - 192135050 - Programmeren 2
    - 192630000 - Telematicadiensten
    - 192610000 - Telematicasystemen en toepassingen
    - 192140250 - Algoritmen, Datastructuren en Complexiteit plus<sup>6</sup>
4. Applicants who satisfy the following requirements are eligible for admission to the Wireless and Sensor Systems specialisation of the CSc Master's programme.
- a. The applicant is holder of a diploma from the University of Twente demonstrating that he or she has satisfied the requirements of the final assessment of the Creative Technology Bachelor's programme.
  - b. The applicant has successfully completed the following electives as part of his or her bachelor's course programme
    - 192131102 - Computer Organisation
    - 192110542 - Computer Systems

Finally, the Dean draws up regulations (transitional arrangements) governing the admission of students to one of the Master's programmes who, prior to 1 September 2003, were enrolled in the single cycle *ingenieur* programme on which the Master's programme is based. These transitional arrangements are outlined in the course guide for single cycle academic programmes. (A single cycle *ingenieur* programme is a four or five year course in engineering, with a diploma at Master's level, in which a Bachelor's programme is included, but without a separate Bachelor's diploma.)

### **Admission to the Master's programmes after individual assessment**

In all other instances, the admissions board conducts a detailed assessment of the applicant's eligibility for admission. This assessment takes the following factors into account:

- a. the highest diploma earned by the applicant: This must be at least a Bachelor's diploma from a recognised higher education institution. If such a diploma cannot be produced, the admissions board will ask for a statement attesting to the equivalency of the applicant's qualifications with the Bachelor's diploma required. The body issuing this statement must be authorised to do so.
- b. the nature of the degree course and the content of the course programme completed by the applicant, the speed with which the course programme was completed and the marks earned: The nature of the degree course, content of the course programme and marks earned for the individual units of study must clearly demonstrate that the applicant has the fundamental academic skills and appropriate basic knowledge for the Master's programme or is able to compensate for any gaps in basic knowledge.
- c. the student's motivation for applying for admission
- d. the applicant's command of English: This only applies to international students. The threshold values for sufficient command of English are in Article 4.4 under a of the Teaching and Examination Regulation.

### **Variations in admission decisions**

#### **Issuing an unconditional certificate of admission**

The admissions board may decide to admit applicants to the Master's programme after assessing their file. These applicants will be issued a certificate of admission.

#### **Issuing a conditional certificate of admission**

The admissions board may not reach a final decision about admission, because it finds insufficient or formally incorrect evidence of the applicant's status in the application file. In such a case the board can decide to admit the applicant conditionally. The student can enrol at the UT on the condition he or she submits the evidence lacking in the original application file to the satisfaction of the admissions board. (A typical case of conditional admission is when the applicant's file shows no formal proof of sufficient proficiency in English.)

#### **Issuing a certificate of pre-Master admission**

In some cases, the admissions board will issue applicants a certificate of pre-Master admission. While these individuals may enrol at the UT, they are not entitled to sit interim examinations or to have the final assessment conducted.

Pre-Master admission is associated with a pre-Master's programme, i.e. a list of units of study, the attainment targets and learning objectives of which are at the undergraduate level.

### **Pre-Master's programme**

By checking the previous (BSc) programme on the presence of courses in programming, software engineering, computer architecture/organization, operating systems, information systems, databases and mathematics, there will be decided upon admittance to master's programme. The student may be admitted or in case of too much discrepancies the student will be rejected.

In most cases the student will be offered a pre-master's programme. Finishing this pre-master's programme successfully will be the requirement for being admitted to the master's programme.

The pre-master's programme contains in all cases a course on algorithms (5 EC) and a course in mathematics (5EC). There will be an individual part of two or three courses (of 5 EC) added on the aspects mentioned above that are lacking in the BSc programme with taking into account the specialization the student wants to choose in the master's programme.

Students in this category must first successfully complete this pre-Master's programme to be fully admitted to the Master's programme and become fully enrolled students with all the associated rights. Certificates of pre-Master admission are valid for a limited term (generally one year). Students who are not fully admitted during this term must re-apply for admission. Completing a pre-Master's programme to convert a pre-Master admission to 'fully admitted' student status is often referred to as 'overcoming deficiencies'.

NB: While the results earned as part of an undergraduate-level pre-Master's programme do not count towards a Bachelor's degree, a certificate is awarded in recognition of the academic achievements during the pre-Master's programme.

### **Issuing a certificate of admission with additional requirements**

The admissions board may attach additional requirements to a certificate of admission (also to conditional and pre-Master admissions). These additional requirements do not impact the right to enrol, sit interim examinations or have the final assessment conducted. They do, however, impact the regulations governing successful conclusion of the Master's programme final assessment. With this admission decision, the admissions board establishes additional requirements for the course programme to satisfy in order to successfully pass the Master's programme final assessment. Naturally, the additional requirements will be limited to the extent that the student will still be able to complete the programme with a study load of 120 credits.

The additional requirements placed on the course programme are referred to as 'homologation'. Please refer to the programme appendix, section e.

**Issuing a certificate of admission with a requirements waiver**

Article 13.3 of the Teaching and Examination Regulation stipulates that the Examination Board may not honour requests for exemptions based on results earned as part of a Bachelor's programme. However, the Examination Board may waive a requirement placed on the course programme in recognition of the results earned as part of a Bachelor's programme and, consequently, permit the student to successfully pass the Master's programme final assessment with a course programme that does not satisfy all the formal requirements. Students who wish to have a waiver for requirements placed on the course programme based on their undergraduate education should submit a request to the admissions board. The admissions board will render a decision on the request on behalf of the Examination Board. If granted, it will issue a certificate of admission with a waiver for requirements, thereby granting the student the right to have the Master's programme final assessment conducted without meeting all the formal requirements. Such a waiver will never affect the Master's programme study load. A study load requirement of less than 120 credits is not permitted.