Programme-specific Annex to the Teaching and Examination Regulations for the Bachelor's programme in Technical Computer Science

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

1. CONTENTS AND STRUCTURE OF THE PROGRAMME

1.1 General objectives of the programme (Article 7.13, paragraph 2c of the Higher Education and Research Act)

The objective of the Bachelor's degree programme in Technical Computer Science is to train students at the Bachelor's level, instilling in them a solid foundation in mathematics and a thorough basic knowledge and understanding of the field of Computer Science. The programme is comprehensive and focuses not only on software and information systems, but also, and especially, on computer systems and communication networks. The programme emphasizes skills and the societal context, and offers students the opportunity to explore another field by taking a minor. Students complete the programme by conducting an individual research project and a group design project.

Most graduates will continue their education by enrolling in a Master's programme, although the expertise and skills they acquire during the Bachelor's programme will allow them to find gainful employment in the field.

1.2 The final attainment targets of the programme (Article 7.13, paragraph 2c of the Act)

Knowledge and experience as relevant to the domain of Technical Computer Science
The graduate has knowledge and understanding of the field of Technical Computer Science. This knowledge includes:

1. Software: programming languages, principles of software development, software engineering, formal methods
2. Computers: architecture and organization, management systems
3. Networks: networks and communications, principles of communication systems
4. Fundamentals of Computer Science: algorithms and complexity, discrete structures, parallel and distributed computing
5. Human Media Interaction: computational science, graphics and visualization, human-computer interaction, intelligent systems
6. Information management: databases
7. Information security: fundamentals of security, network security, cryptography
8. Mathematics: discrete mathematics, calculus, linear algebra, probability and statistics

Design

1. The graduate is capable of the integrated application of relevant, field-specific knowledge to systems design.
2. The graduate is capable of specifying a problem and devising a solution based on a general description of the problem.
3. The graduate is capable of devising solutions/designing systems by selecting and implementing methods, models and techniques.
4. The graduate is capable of evaluating the properties of solutions/systems and of making a substantiated choice between different solutions based on his/her evaluation.

Research

1. The graduate is capable of critically analysing field-specific problems.
2. The graduate is capable of systematically setting up and implementing a research project.
3. The graduate is capable of contributing to the further development of the field by working in a sub-field.

Organizational ability

1. The graduate is capable of independently acquiring and incorporating new knowledge and skills as required.
2. The graduate is capable of analysing and discussing ethical, social, cultural and societal aspects of problems, solutions and developments in the field.
3. The graduate understands team dynamics, and is capable of working in a team and with a variety of stakeholders such as the client and end-users.
4. The graduate is capable of communicating effectively with colleagues and non-specialists, both orally and in writing.
5. The graduate is capable of organizing his/her working processes and reflecting on their effectiveness.
6. The graduate is capable of taking a position on an issue and of substantiating this position with regard to a design or scientific argument.
7. The graduate has a multidisciplinary attitude.
8. The graduate has intercultural skills.

1.3 Content of the programme and related examinations (Article 7.13, paragraph 2a of the Act)

The table below shows the units of study comprising the Twente Education Model (TOM) curriculum. Section 1.3.3 of this Annex contains a curriculum that has been adjusted for the combined final degree audit for Technical Computer Science and Applied Mathematics. The Board of Examiners of the relevant programme is to publish details regarding the content of a unit of study in the course catalogue at least six weeks before the start of the teaching period (semester or quarter) in which the unit of study is offered.

1.3.1 The TOM curriculum (Cohorts from 2013 and later)

The table below shows the subjects in the order in which they are offered, the student's preferred prior knowledge and any additional prerequisites. The associated examination tables are included in Annex 1.

Table 1.

Course code	Course name	Q	Prerequisites
Year 1			
201300070	Pearls of Computer Science	1A	
201500111	Software Systems	1B	Advisable: 201300070 (Math A +B1)
201600146	Network Systems	2A	Advisable: 201300070
201300180	Data & Information	2B	Advisable: 201500111
Year 2			
201400210	Computer Systems	1A	
201600105	Intelligent Interaction Design	1B	
201400433	Discrete Structures & Efficient Algorithms	2A	Advisable: 20140021 (discrete mathematics)
xxxxxxxxx	Elective / Minor	2B	Compulsory for Minor: 60EC upon registration
Year 3			
xxxxxxxxx	Elective / Minor	1A	Compulsory for Minor: 60EC upon registration
xxxxxxxxx	Elective / Minor	1B	Compulsory for Minor: 60EC upon registration
201500121	Design Project	1A/2A	Compulsory: 120EC (Excluding minor)
201500120	Research Project	1B/2B	Compulsory: 120EC (Excluding minor)

1.3.1.a Elective module

The following modules are available to students as elective modules (students are to choose one).

Table 2.

Course code	Course name	Q	Prerequisites
201500053	Cyber-Physical Systems	1B	
201500025	Web Science	1B	
201400537	Programming Paradigms	2B	Advisable: 201500111
201500057	Smart Spaces	X	

1.3.1.b Minors

See Article 3.2 of the general section of the Teaching and Examination Regulation. The in-depth module may be completed by choosing a second elective module from Table 2. Students who choose one of the following options for their minor must first obtain permission from the Examination Board:

- Exchange Minor (EM);
- In-depth initiatives (IM), see Table 2;
- Multi Minors (MM);
- Individual minor.

The Examination Board uses the following guidelines to assess the student's request:

1. The educational component of the minor must be at an academic level;
2. At least 15 of the 30 credits must involve a paradigm shift;
   - The contents of the minor must not fall within the field of computer science; or
   - The contents of an exchange minor may fall within the field of computer science, provided that the minor is taken at an institute of higher education abroad and the educational component of the minor is at an academic level.
3. The educational component of the minor may not overlap with the programme's compulsory units of study;
4. Up to five credits may be devoted to courses on the language and culture of the host country.

See www.utwente.nl/ti for further information regarding the Examination Board's procedure for approving the minor. Once approval has been granted, the Bureau of Educational Affairs (BOZ) is responsible for the administrative procedure involved in enrolling the student in the relevant minor.

1.3.1.b Sequence requirements (Article 7.13, paragraph 2s of the Act)

1. A student may enrol in the minor through the Bureau of Educational Affairs once he/she has earned at least 60 credits;
2. A student may only enrol in the final semester modules Design Project (201500121) and Research Project (201500120) once he/she has earned at least 120 credits, excluding minors;

1.3.2. The pre-TOM curriculum (Cohorts from 2012 and earlier)

Students who enrolled in the Bachelor's in Technical Computer Science prior to 1 September 2012 must arrange for an individual examination programme.

1.3.3. Applied Mathematics and Computer Science double degree

An adjusted curriculum applies to students pursuing a double degree in Technical Computer Science and Applied Mathematics. This programme is detailed on the next page.

The chart on the next page shows the components of the units of study. In each quarter, the components listed under Applied Mathematics form a cohesive unit of study, as do the components under Technical Computer Science.

1.4 Programme format (Article 7.13, paragraph 2i of the Act)

The programme is only offered on a full-time basis.

2. Language of tuition (Article 3.3, paragraph 1 of the Teaching and Examination Regulations)

The programme is taught in English for the 2016 cohort (and later cohorts), and in Dutch for the 2015 cohort (and earlier cohorts).

Dubbelprogramma TI/TW, 2016-2017

1e jaar

Kwartiel 1	21 EC
gezamenlijk: *Math A*	1,5 EC
module 1 TW: *Lineaire Structuren*	6 EC
module 1 TI: *Math B1*	2,5 EC
Parels	8 EC
Project TI	3 EC

Kwartiel 2	21 EC
module 2 TW: *Lin.Struc II*	
Analyse I	
Project: prooflab	10 EC
module 2 TI: *Math B2*	3 EC
Programmeren theorie en project	8 EC

Kwartiel 3	20 EC
module 3 TW: *Signalen en Transf.*	5 EC
deel Kansrekening	3 EC
module 3 TI: *Network Systems (excl Math C1)*	12 EC

Kwartiel 4	20 EC
module 4 TW: *Vector Calculus*	5 EC
module 3 TW *deel Kansrekening*	2 EC
module 4 TI: *Data & Informatie excl. Kansrekening*	12 EC

2e jaar

Kwartiel 1	20 EC
module 5 TW: *Wisk. Statistiek*	5 EC
module 5 TI: *Computer Systems*	15 EC

Kwartiel 2	20
module 6 TW: *Differentiaalvergl*	
Systeemtheorie	8 EC
module 6 TI: *Intelligent Interaction Design (excl Statistiek)*	12 EC

Kwartiel 3	21 EC
gezamelijk: *Discrete Structuren & Efficiënte Algoritmen*	15 EC
uit mod 3 TW: Project *(inclusief intro Wisk. Mod.)*	6 EC

Kwartiel 4	15 EC
module 8 TW: *Modelling and Analysis of stochastic processes for Math*	15 EC

3e jaar

Kwartiel 1	10 EC
module 5 TW: *Analyse II*	
Project	
Presenteren	10 EC

Kwartiel 2	15 EC
minorruimte	15 EC

Kwartiel 3	15 - 20 EC
afstudeerfase	

Kwartiel 4	15 - 20 EC
afstudeerfase	

Totale omvang van dit programma:

tussen de 213 EC en 223 EC

3. ASSESSMENT

3.1 Assessment and examination formats (Article 7.13, paragraph 2l of the Act)

Annex 1 details the examination format for each unit of study.

3.2 Examination transparency

The programme is to ensure that information is made available for each examination regarding its level, structure and marking norms, e.g. by providing a sample examination, an examination from a previous year or a collection of sample examination questions.

3.3 Period of inspection

Notwithstanding the provisions of Article 4.8, paragraphs 2 and 3 of the Teaching and Examination Regulations Guideline, an opportunity for an individual or group discussion of the examination must be offered at least three working days prior to next examination opportunity.

3.4 Registration of results

1. Exemptions for examinations are indicated with the code 'VR'.
2. Exemptions are assigned a numerical value of 6.
3. The alphanumeric results of complete (V) and incomplete (NVD) have no numerical values.
4. The highest mark achieved counts. This also applies to tests.

3.5 Validity of constituent marks[1]

1. Annex 1 contains examination tables as a supplement to Article 4.1, paragraph 9 of the Teaching and Examination Regulations Guideline. The examination tables indicate the indivisible components of a module with a Roman numeral. The period of validity of indivisible components consisting of one or more constituent marks (i.e. one academic year) may be extended by an additional academic year. Following this extension, the components lose their validity and the student must resit the entire module.
2. The conditions for extending the validity of constituent marks are as follows:
    a. A pass (i.e. 5.5 or higher) must be achieved for the indivisible components. Passes (i.e. 5.5 or higher) for all constituent marks must be achieved in the case of an indivisible component with multiple constituent marks. This is the case whether or not a compensation arrangement applies.

3.6 Participation in examinations

1. Students may participate in examinations of module components offered during the module in the relevant academic year and in the following academic year;
2. Further to point 1 above, a student who is eligible for an extension of validity of constituent results of a module may participate in an additional resit for constituents not yet passed during the summer break if the programme offers such a resit. This resit opportunity applies only once during the summer break and for all modules together.
3. Points 1 and 2 do not apply if a module has already been passed.

3.7 Third attempt

If a student requires more than two consecutive academic years to pass a module, then the student must agree on a study plan together with the Study Advisor at least two weeks prior to the start of the relevant module. The study plan must include agreements on time keeping, active participation in tutorials and other aspects of the module, and it must be submitted to the programme director for approval.

[1] The provisions in this article are consistent with the rules for extension of validity of module component grades of the study programme(s) which module is shared.

3.9 Pass/Fail Regulation

1. Students who meet the following requirements will pass the Bachelor's final degree audit for the TI programme:
   a. The student has received an assessment for all units of study of the Bachelor's final degree audit;
   b. The student's marks are 6 or higher for all units of study;

   In all other cases, the student will not pass the final degree audit and will not receive a Bachelor's degree.

3.10 Cum Laude

1. A student may pass the Bachelor's final degree audit with distinction (cum laude) upon meeting the following requirements:
   a. The student passes the Bachelor's final degree audit within four years of initial enrolment (performance requirement);
   b. The student's average mark is 8.0 or higher (non-numeric assessments not included). This is a weighted average based on the relative number of credits per unit of study.
   c. No more than one unit of study may have a mark of 6.
   d. The mark for the Research Project (201500120) is 8 or higher.
2. In exceptional cases and at the student's request, the Examination Board may award the distinction of cum laude if the student has met all requirements with the exception of the performance requirement, due to extenuating circumstances. These circumstances may involve delays recognized and provided for by the institution. It should be noted that the distinction of cum laude is never awarded automatically, but only following individual assessment of the student's academic achievements.

3.11 Confidentiality

1. Reports of final assignments are public documents except in the following cases.
2. The Programme Board may deem a report to be confidential for a specific period based on a detailed request:
   a. The first supervisor must submit a request to the Programme Board prior to the start of the final assignment.
   b. The confidential report must be accessible/available to the committee responsible for assessing the final assignment, the Programme Board, and representatives of bodies that have a statutory duty of overseeing the quality of the assessment or the programme as a whole.
   c. The parties mentioned above are required to observe confidentiality with regard to the report.
3. In the case of a confidential report as referred to in point 2, the public presentation of the report may be amended to ensure that no confidential information is made public.

4. BINDING RECOMMENDATION (BSA)

When issuing binding recommendations (BSA) as referred to in Article 6.3, the programme attaches no additional provisions to the first year for regular students (Article 6.3, paragraph 7).

Students pursuing a double degree in Technical Computer Science and Applied Mathematics are subject to an additional BSA provision: the BSA may involve removal from the Applied Mathematics programme if the student fails to earn 15 or more credits from the units of study associated with the Technical Computer Science programme.

5. ADMISSION

5.1 Admission requirements

The requirements for admission are as follows:

1. The applicant must have completed pre-university education (vwo) or equivalent;
2. The applicant must have passed Mathematics B at pre-university level (vwo) or equivalent;
3. English:
    a. The applicant must have a secondary school diploma including English as an examination subject from a country that has ratified the Lisbon Treaty; or
    b. CEFR, B2/C1 level; or
    c. IELTS score of 6.0 or higher; or
    d. TOEFL score of 80 or higher.
4. There are no additional provisions regarding admission to the programme as provided for in Article 2 of the general section of these Teaching and Examination Regulations and the document mentioned therein entitled 'Entrance Examination and other admission regulations for admission to Bachelor's programmes'.

5.2 Admission to a Master's programme

A student with a Bachelor's degree in Technical Computer Science will gain automatic admission to the following Master's programmes:

- Computer Science
- Embedded Systems (3TU)
- Human Media Interaction
- Internet Science & Technology (formerly known as Telematics)

6. STUDY MATERIALS

Students starting on the programme in September 2013 or later must obtain an 'ultra notebook' from the Notebook Service Centre (or acquire a device with similar specifications).

Annex 1: Assessment Tables

201300070 Pearls of Computer Science						
Module part		Type of assessment	Individual / Group	Weight within part (%)	Minimum grade	Weight part (%)
I	Math A & B1	Written test	I	100	5.5*	27
II	Pearls	8x written test	I	12.5% each	5.5 each*	53
		8x assignment	G	Pass for access to written test		
	Weighted sub-average				**5.5***	
	Project	Project- testing	G	100	5.5	20
	Academic Skills	Assignment	I	Pass	Pass	0
Weighted average					**5.5**	

*OR 'Math A & B1' 5.0=<grade<5.5 OF TWO Pearls 5.0=<grades<5.5 is allowed IF the sub-weighted average is 5.5 or higher (grade =>5.5).

201500111 Software Systems						
Module part		Type of assessment	Individual / Group	Weight within part (%)	Minimum grade	Weight part (%)
I	Math B2	Written test	I	100	5.5*	20
II	Design	Written test	I	100	5.5*	20
		Assignment	I	Pass		
	Programming	Written test	I	100	5.5*	20
		Assignment	I	Pass		
	Sub-weighted average				**5.5***	
	Design Project	Report	G	100	5.5	20
	Programming Project	Product	G	100	5.5	20
		Report	G			
	Academic Skills	Assignment	I	Pass	Pass	0
Weighted average					**5.5**	

*Out of the marked (*) module component grades ONE mark lower than 5.5, but at least 5.0 (5.0 = <rate <5.5) is allowed IF it's sub-weighted average is 5.5 or higher.

201600146 Network Systems						
Module part		Type of assessment	Individual / Group	Weight within part (%)	Minimum grade	Weight part (%)
I	Math C	Written exam	I	100	5.5*	20
II	Network Systems Theory	4x written exams	I	100	5.5 each*	50
	Observation lab	Assignments	I	Pass	Pass	0
				Sub-weighted average	**5.5***	
	Network Systems Project	Challenges	G	50	5.5	30
		Project testing	G	50	5.5	
	Academic Skills	Assignments	I	Pass	Pass	0
				Weighted average	**5.5**	

*Out of the marked (*) module component grades ONE mark lower than 5.5, but at least 5.0 (5.0 = <rate <5.5) is allowed IF it's sub-weighted average is 5.5 or higher.

201300180 Data & Information						
Module part		Type of assessment	Individual / Group	Weight within part (%)	Minimum grade	Weight part (%)
I	Probability	Written test	I	100	5.5*	20
II	5 Themes	4x Written test	I	100 each	5.5 each*	4x 10
				Sub-weighted average	**5.5***	
	Project	Product	G	100	5.5	40
		Report	G			
		Presentation	G			
	Academic Skills	Assignment	I	Pass	Pass	0
				Weighted average	**5.5**	

*Out of the marked (*) module component grades ONE mark lower than 5.5, but at least 5.0 (5.0 = <rate <5.5) is allowed IF it's sub-weighted average is 5.5 or higher.

201400210 Computer Systems						
Module part		Type of assessment	Individual / Group	Weight within part (%)	Minimum grade	Weight part (%)
I	Discrete Mathematics	Written test	I	100	5.5*	20
	Operating Systems	Assignment	I	100	5.5*	26
		Oral test	I	Pass		
		Written test	I	If assignment grade is <5.5		
	Computer Architecture & Organisation	Written test	I	100	5.5*	20
		Assignment	I	Pass		
				Sub-weighted average	**5.5***	
	Project	Project plan	G	30	5.5	27
		Daily reports	G	Pass		
		Video	G	30		
		Demo	G	40		
		Reflection report	I	Pass		
	ICT & Law	Participation	I	Pass	5.5	7
		Written test	I	50		
		Report	G	50		
				Weighted average	**5.5**	

*Out of the marked (*) module component grades ONE mark lower than 5.5, but at least 5.0 (5.0 = <rate <5.5) is allowed IF it's sub-weighted average is 5.5 or higher.

201600105 Intelligent Interaction Design						
Module part		Type of assessment	Individual / Group	Weight within part (%)	Minimum grade	Weight part (%)
I	Design & Evaluation of HCI	Written test	I	100	5.5*	20
	Statistical Techniques	Written test	I	100 – bonus x 5	5.5*	20
		4 assignments for bonus points	I	5% each**		
	AI Theory	Written test	I	100	5.5*	20
		Sub-weighted average			**5.5***	
	AI Practical	Lab test	G	100	5.5	15
	HCI project	Project testing	G	100	5.5	25
		Weighted average			**5.5**	

* Out of the marked (*) module component grades ONE mark lower than 5.5, but at least 5.0 (5.0 = <rate <5.5) is allowed IF it's sub-weighted average is 5.5 or higher.
** IF assignment grade > written test grade

201400433 Discrete Structuren & Efficiënte Algoritmes						
Module part		Type of assessment	Individual / Group	Weight within part (%)	Minimum grade	Weight part (%)
I	Discrete Structures & Algorithms	Written test	I	100	5.5*	35
	Algebra & Finite Automata	Written test	I	100	5.5*	35
	Homework bonus	Assignment	I	Max +1.0 grade point on top of sub-weighted average		
	Sub-weighted average (excluding bonus)				**5.5***	
	Research	Product	G	Pass	5.5	30
		Paper	G	100		
		Presentation	G			
		Programming competition Bonus	G	Max +2.0 grade point		
	Weighted average (excluding bonus)				**5.5**	

* Out of the marked (*) module component grades ONE mark lower than 5.5, but at least 5.0 (5.0 = <rate <5.5) is allowed IF it's sub-weighted average is 5.5 or higher.

Elective: 201400537 Programming Paradigms						
Module part		Type of assessment	Individual / Group	Weight within part (%)	Minimum grade	Weight part (%)
I	Functional Programming	Written test	I	50 each	5.5*	15
	Concurrent Programming	Written test	I	100	5.5*	20
		Bonus	I	+1 grade point		
	Compiler Construction	Take home test	I	50 each	5.5	20
	Sub-weighted average				**5.5***	
	Functional & Logic Programming Projects	Project testing	G	50 each	5.5	15
	Integration Project	Project testing	G	100	5.5	30
Weighted average					**5.5**	

* Out of the marked (*) module component grades ONE mark lower than 5.5, but at least 5.0 (5.0 = <rate <5.5) is allowed IF it's sub-weighted average is 5.5 or higher.

Elective: 201500053 Cyber Physical Systems						
Module part		Type of assessment	Individual / Group	Weight within part (%)	Minimum grade	Weight part (%)
I	Formal specification and hybrid systems	Take home test	I/G	100	5.5*	14
	Dependable systems and networks	Take home test	I/G	50	5.5*	14
		Presentation	I/G	50		
	Sensor and actuator systems	Written test	I	50	5.5*	14
		Mini-lab	G	50		
	Real-time operating systems	Written test	I	50	5.5*	14
		Lab report	G	50		
	Physical-systems modeling and controller design	6 reports on assignments & lab	G	16,66 each	5.5*	14
				Sub-weighted average	**5.5***	
	Project	Project artefacts	G	25	5.5	30
		Presentations	G	25		
		6-page research paper	G	25		
		Youtube movie	G	25		
				Weighted average	**5.5**	

* Out of the marked (*) module component grades ONE mark lower than 5.5, but at least 5.0 (5.0 = <rate <5.5) is allowed IF it's sub-weighted average is 5.5 or higher.

Elective: 201500025 Web Science						
Module part		Type of assessment	Individual / Group	Weight within part (%)	Minimum grade	Weight part (%)
I	Web Science	2x written test	I	50 each	5.5	50
	Implementation Projects	5x report	G	100*	5.5	50
		Presentation	G	Pass		
				Weighted average	**5.5**	

*weight 2wk project is 2x weight 1wk project

201500121 Design Project						
Module part		Type of assessment	Individual / Group	Weight within part (%)	Minimum grade	Weight part (%)
I	Design Project	Project testing	G	100	5.5	67
	Reflection Component	Assignments	G	100	5.5	33
			Weighted average		**5.5**	

201500120 Research Project						
Module part		Type of assessment	Individual / Group	Weight within part (%)	Minimum grade	Weight part (%)
I	Research Project	Project testing	I	100	5.5	67
	Reflection component	2x Assignment	I	100	5.5	33
			Weighted average		**5.5**	