APPENDIX TO TEACHING AND EXAMINATION REGULATIONS

IMPLEMENTATION REGULATIONS

2010-2011

3TU MASTER'S DEGREE PROGRAMME

Systems and Control

DELFT UNIVERSITY OF TECHNOLOGY
UNIVERSITY OF TWENTE
EINDHOVEN UNIVERSITY OF TECHNOLOGY

Article 1 - Study load

1. The Master's degree audit for the Systems and Control programme 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 programme will be taught in full-time.

Article 2 - Composition of the degree programme

1. The composition of the study programme for the student generation 2010-2011 is as follows:
   a. Core programme, as described in Article 3,
   b. Specialisation-linked subjects,, as described in Article 4,
   c. Elective subjects, as described in Article 5,
   d. Internship/project block, as described in Article 6,
   e. Specialisation-linked graduation work, as described in Article 8.

2. Before being admitted to the programme on the basis of a Bachelor's degree awarded by a Dutch institute of professional education, students must also complete a bridging programme (preferably within a year of commencing their course of study) that includes the following subjects:

   At Delft University of Technology:

Code	Course	Credits
wi1909th	Differentiaalvergelijkingen voor TH-studenten,	3
wi1807th	Lineaire algebra voor TH-studenten,	3
wi1708th1	Analyse voor TH-studenen deel 1,	3
wi1708th2	Analyse voor TH-studenten deel 2,	3
wi1708th3	Analyse voor TH-studenten deel 3,	3
wi3104tn	Probablility and Statistics	3
sc3011tn	Stochastische signaalanalyse	3
tn2545	Systems and signals	6
wb2207-07	Regeltechniek	3

   At the University of Twente:

Code	Course	Credits
191512001	Calculus A	4
191512021	Calculus B	3
191512041	Calculus C	3
191512061	Lineaire Algebra A	3
191512081	Lineaire Algebra B	2
191210440	Regeltechniek	4
191231490	Lineaire Systemen	6
191571080	Random Signals and Systems	5

   At Eindhoven University of Technology:

Code	Course	Credits
2DL03	Basis Wiskunde[1]	3
2DL04	Calculus A[1]	3
2DL06	Linear Algebra[1]	3
4A250	Signaalanalyse[3]	3
5DD20	Systemen[4]	6

4A320	Systeemanalyse[4]	3
5DD30	Signalen[3]	5
4A551	Regeltechniek[2]	3
5CC50	Regeltechniek[2]	3
4A461	Mechanische Trillingen	3
4C620	Constructieprincipes	3
4C530	Analyse van fabricagesystemen	3
5CC70	Adaptieve systemen	3
5CC60	Digitale signaalverwerking	3
2N460	Numerieke Methoden	
2S610	Kansrekenen en Stochastische processen	3
2DL05	Calculus B	3

[1] Obligatory
[2] Obligatory one of the two courses 4A550 or 5CC50
[3] Obligatory one of the two courses 4A250 or 5DD30
[4] Obligatory one of the two courses 4A320 or 5DD20

At Eindhoven University of Technology the following regulations hold:

- The obligatory part of the bridging courses is completed with other courses of the above list to a total of minimally 30 EC
- Obligatory mathematics courses are scheduled twice a year
- Per course, maximally 2 examination resits are permitted.
- Exam and practical results expire after maximally 3 years

The three bridging programmes are interchangeable.

Article 3 - Core programme

Students must complete one of the three core programmes shown below, totalling 23 or 24 credits. The three core programmes are interchangeable.

At Delft University of Technology:

Code	Course	Credits
sc4010	Introduction project SC	3
sc4025	Control theory	6
sc4032	Physical modeling for Systems and Control	4
sc4040	Filtering & identification	6
sc4050	Integration project SC	5

At the University of Twente:

Code	Course	Credits
200900013	Introduction project	3
191211110	Modeling: Modelling and Simulation[*]	5
191211100	Mechatronic Design of Motion Systems[*]	5
191571090	Identification: Time Series analysis	5
191210770	Control: Digital Control Engineering (Opt.Ctr.I)	5
200900012	Integration project	5

[*] One of the two courses 191211110 or 191211100 is to be chosen

At Eindhoven University of Technology:

Code	Course	Credits
4K410	Introduction project (Digital Motion Control)	3
4J520	Modeling (Non-linear dynamics)[*]	3
5MX00	Modeling (Dynamical Systems)[*]	3
4K560	Modeling (Physical modeling for S&C)	3
4J560	Identification (A numer-experim approach in SD)	3
5MB40	Identification (System Identification)	3
4K580	Control (System theory for control)	3
5SC20	Control (State space control)	3
4K150	Control (Advanced motion control)	3
4SC00	Integration project Systems and Control	3

[*] One of the two courses 4J520 or 5MX00 is to be chosen.

Article 4 – Specialisations and specialisation-linked subjects.

For each specialisation, courses are selected from the list of elective courses, with a total of 9 or 10 credits, after consultation with the graduation supervisor of one of the chairs of the specialisation, and to be approved by the Board of Examiners.

1. No specialisations are offered at Delft University of Technology. In consultation with the MSc coordinator a list of courses is chosen from the list of elective courses, specified in Article 5 of the appendix, or technical courses from another MSc programme.

2. The following specialisations are/will be offered at the University of Twente:
   1. Robotics and Mechatronics
   2. Systems and Control Theory

3. The following specialisations are/will be offered at the Eindhoven University of Technology:
   1. Control Systems
   2. Control Systems Technology
   3. Dynamics and Control
   4. Electromechanics and Power Electronics
   5. Systems Engineering
   6. Hybrid and Networked Systems
   Together with the 20 or 21 credits of elective courses, as explained in Article 5 of the appendix, the 9 or 10 credits for the specialisation constitute the list of elective courses that has to be approved by the graduation supervisor of the specialisation.

Article 5 – Elective subjects

Elective subjects, totalling 20 or 21 credits, should be selected from the following lists from the three universities in question. In consultation with the graduation supervisor courses from all three universities can be chosen. These lists can be expanded, after approval of the Board of Examiners.

Explanation of research theme abbreviations:

Fu:	Fundamentals	Ma:	Mathematics
ST:	System Theory	RM:	Robotics & Mechatronics
PC:	Process Control	CS:	Computer Science
BT:	Biotechnology	ES:	Embedded Systems

MT: Mechatronics   MC: Motion Control
Tr: Transportation   NC: Non-linear Control
Ae: Aerospace   AM: Automotive

Offered at Delft University of Technology:

| Course code | Course name | EC | Research Themes | | | | | | | |
			Fu	ST	PC	BT	RM	Tr	Ae	AM
SC4060	Model predictive control	4		x	x	x		x	x	
SC4081	Knowledge based control systems	4			x	x		x		
SC4091	Optimization in Systems and Control	4			x	x		x		
SC4110	System identification	5		x	x		x			
SC4120	Special topics in signals, syst. and contr.	3		x						
SC4150	Fuzzy logic and engineering applications	3		x		x		x		
SC4160	Modeling and control of hybrid systems	3		x		x		x	x	
SC4210	Vehicle mechatronics	4					x	x		x
SC4230TU	Vehicle dyn.B–Antilock Braking Systems	3					x	x		x
SC4240TU	Control methods for robotics	3		x			x			
WB2305	Digital control	3			x	x	x	x	x	
WB2415	Robust control	6		x			x		x	
WB2421	Multivariable control systems	6		x	x	x	x	x	x	
WB4432-05	Process dynamics and control	3			x	x				
WI4209	Systems and Control	6	x	x						
WI4217	Control of discrete-time stochastic systems	6	x	x						
WI4218	Convex optimization and systems theory	6	x	x						
AE3302	Flight dynamics 1	4							x	
AE4301	Automatic flight control system design	3							x	
AE4305	Spacecraft attitude control systems	3							x	
AE4361	Flight and space simulation	4							x	
CT4801	Transportation and spatial modeling	6						x		
CT4821-09	Traffic flow theory and simulation	6						x		
CT4822-09	Traffic management and control	6						x		x
CT5804-09	Innovations in dynamic traffic management	4						x		x
ET4245ME	Electromechanics in mechatronic systems	3					x			
LM3511TU	Systems biology	6			x	x				
ME1100	Automotive Crash Safety; Active & Passive Safety Systems	3						x		x
WB2303-08	Measurement in Engineering	3					x			
WB2414-09	Mechatronic system design	4					x			
WB2427	Predictive modeling	3					x			

Offered at the University of Twente:

Course code	Course name	EC
191560671	Robust Control	5
191561620	Optimal Control	5
191211060	Modern Robotics	5
191211110	Modeling and simulation	5
191131700	System identification and parameter estimation	5
191210760	Advanced Programming	5
191211080	Systems Engineering	5
191211090	Real-Time Software Development	5
191211100	Mechatronic Design of Motion Systems	5
191561750	Infinite Dimensional Linear Systems	6
191561680	Nonlinear control	5
191571200	Hybrid Dynamical Systems	5
192140122	System Validation	5
191211070	Intelligent Control	5
191571501	Stochastic Differential Equations	6
191571160	Stochastic Filtering and Control	5
191131720	Advanced motion and vibration control	5
191131730	Dynamics of machines	5
191131360	Design Principles for precision mech.	5
191210930	Measurement Systems for MEchatronics	5
191157740	Advanced Dynamics	5
191210920	Optimal Estimation in Dynamic Systems	5
191561560	Systems and Control	6
191157170	Statics	2
191157140	Dynamics 2	3.5
191157110	Introduction to the Finite Element Method	5
196700120	Dynamical Systems	5
191210001	Instrumentation for embedded systems	5
191210430	Engineering System Dynamics	3
191157150	Mechanics of Materials 2	3.5

Offered at Eindhoven University of Technology:

Course code	Course name	EC	Research Themes						
			Fu	ST	MC	NC	MT	PC	AM
4J560	A numerical experimental approach in structural dynamics	3	x	x			x		x
4C650	Analysis of hybrid systems	3		x		x		x	x
4AT00	Power Train Components	3							x
4J100	Control of nonlinear mechanical systems	3		x		x			
4J400	Multi-body dynamics	3	x		x	x	x		x
4J530	Engineering optimization: concepts and applications	3			x	x	x	x	x
4J570	Advanced vehicle dynamics	3							x

Code	Course	Cr							
4J580	Humanoid robotics	3			x	x	x		
4J590	Performance of nonlinear control systems	3		x		x			
4J820	Applied nonlinear control	3			x	x	x		
4L810	Fundamentals of systematic low noise design	3					x		x
4L150	Vehicle dynamics	3							x
4C660	Dynamics and control of hybrid manufacturing systems	3					x	x	x
4K140	Capita Selecta in control	3		x					
4K160	Modeling, analysis and control of hybrid dynamical systems	3	x	x					
4K420	Supervisory machine control	3						x	
4K450	Embedded motion control	3			x		x		
4K480	Control and Operation of Tokamaks	3				x		x	
4K490	Advanced control for fusion plasmas	3				x		x	
4T500	Modeling and control of manufacturing systems	3						x	
4N630	Fluid power transmission and servo systems	3			x			x	x
4T700	Engineering optimization: advanced topics	3			x	x	x	x	x
4L160	Introduction robotics	3			x	x	x		
5SC21	Modeling and predictive control	3		x				x	
5ME10	Statistical Signal processing	3	x	x					
5MB10	Model reduction	3		x	x		x	x	
5MB30	Robust control	3		x	x		x	x	
5MJ00	Electrical machines I	3			x		x		x
5P060	Nonlinear systems/neural networks	4					x		
5EE90	Electrical Components	3						x	
5EP10	Design and application of industrial linear motors	3			x		x		

Article 6 – Internship/Project Block

1. Students must complete an internship/project block.
2. The internship/project block consists of
   Alternative a:
   - An internship worth 20 credits (see also Article 7)
   - Elective courses from the list, specified in Article 5, worth 6 credits.

   Alternative b:
   - An internship worth 15 credits (see also Article 7)
   - Elective courses from the list, specified in Article 5, worth 6 credits.

   Alternative c:
   - An literature study worth 15 credits (see also Article 7)
   - Elective courses from the list, specified in Article 5, worth 6 credits.

   Alternative d:
   - A literature study worth 15 credits (see also Article 7)
   - 3 credits on technical MSc courses from a different MSc program, that are not contained in the list, specified in Article 5.
   - 3 credits on non-technical MSc courses.

3. In Delft Alternative d is mandatory. In Twente Alternative a is mandatory. In Eindhoven students can choose between Alternative b and Alternative c.

Article 7 – Literature Study/Internship

1. Students may not commence a literature study or an internship until they have:
   - completed the core programme referred to in Article 3,
   - completed a bridging programme (in the event that such a programme was required in accordance with Article 2, paragraph 2),
   - passed the Bachelor's audit referred to in Article 4 paragraph 1 of the Teaching and Examination Regulations (if applicable).

Article 8 – Graduation Work

1. Students complete graduation work which is related to their selected specialisation. At Delft University of Technology and Eindhoven University of Technology this graduation work is worth 45 credits. At the University of Twente the graduation work is worth 40 credits.

2. Graduation work consists of a graduation project, a graduation report, a summary of the report (Twente and Eindhoven), a poster (Eindhoven), two intermediate presentations (Delft), participation in MSc workshops (Delft) and a final presentation.

3. Students may not commence graduation work until they have completed all of the remaining components of the study programme.
   In exceptional cases the graduation supervisor may permit a deviation of this regulation after consultation with and permission from the Board of Examiners.

Article 9 – Study Programme

1. Before commencing graduation work, students must draw up their study programme and submit this to the Board of Examiners for approval.

2. Each individual amendment to an approved study programme must be resubmitted to the Board of Examiners for approval.

Article 10 - Free degree programme

1. Students can compile their own degree programme, with an associated degree audit. The degree programme, which requires prior approval by the Board of Examiners, must consist wholly or largely of components taught at one of the three universities within the framework of, or in support of, the programme. It may be supplemented by components taught within the framework of, or in support of, other degree 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.

Article 11 – Practical exercises

1. Practical exercises, as described in Article 1 subsection f of the Teaching and Examination Regulations, are taught in accordance with the method described in the prospectus of the subject in question.

2. Any students who fail to complete the practical exercises will be barred from sitting the examination, unless stated otherwise in the prospectus of the subject in question.

Article 12 - The form of the examinations

1. Examinations will be administered in accordance with the details set out in the prospectus of the subject in question.

2. Examinations held by another programme within the framework of another programme are administered in accordance with the procedure set out in, or pursuant to, the Teaching and Examination Regulations of that other programme.

Article 13 – The frequency, terms and sequence of examinations

1. Written and oral examinations are held immediately after the teaching period for the course to which the examination in question relates.

2. Written examination resits are held as follows:
   - examination after teaching period 1: resits after teaching period 2
   - examination after teaching period 2: resits after teaching period 3
   - examination after teaching period 3: resits after teaching period 4
   - examination after teaching period 4: resits after teaching period 1 (Eindhoven)
                                         resits during the August resit period (Delft and Twente)

3. Participation in practical exercises is governed by the timetables drawn up for this purpose.

Article 14 - Transitional regulations
Not applicable.