Master 2005 - 2006

SC-Guide

Study guide Master programme Systems and Control

TU Delft

Faculty of Mechanical, Maritime and Materials Engineering

Delft University of Technology

Academic Calendar 2005-2006

ACTIVITY	WEEK		DATE
1a	1	36	05-09-05
	2	37	12-09-05
	3	38	19-09-05
	4	39	26-09-05
	5	40	03-10-05
	6	41	10-10-05
	7	42	17-10-05
	8	43	24-10-05
	9	44	31-10-05
1b	1	45	07-11-05
	2	46	14-11-05
	3	47	21-11-05
	4	48	28-11-05
	5	49	05-12-05
	6	50	12-12-05
	7	51	19-12-05
		52	26-12-05
		1	02-01-06
	8	2	09-01-06
	9	3	16-01-06
	10	4	23-01-06
	11	5	30-01-06
2a	1	6	06-02-06
	2	7	13-02-06
	3	8	20-02-06
	4	9	27-02-06
	5	10	06-03-06
	6	11	13-03-06
	7	12	20-03-06
	8	13	27-03-06
	9	14	03-04-06
2b	1	15	10-04-06
	2	16	17-04-06
	3	17	24-04-06
		18	01-05-06
2b	4	19	08-05-06
	5	20	15-05-06
	6	21	22-05-06
	7	22	29-05-06
	8	23	05-06-06
	9	24	12-06-06
	10	25	19-06-06
	11	26	26-06-06
	12	27	03-07-06
		28	10-07-06
		29	17-07-06
		30	24-07-06
		31	31-07-06
		32	07-08-06
		33	14-08-06
		34	21-08-06
		35	28-08-06

legenda	
1a	Lectures, projects
	Examinations
	Holiday
	White weeks

14-04-06	Easter Friday
17-04-06	Easter Monday
25-05-06	Ascensionday
05-06-06	Whitsuntide
18.8.06	1st day examination period
31.8.06	last day examination period

SC - Guide

Master 2005 - 2006

SC-Guide

Study guide Master programme Systems and Control

Colophon

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Preface

The MSc programme Systems and Control is directed towards the analysis and design of reliable and high-performance measurement and control strategies for a wide variety of technological dynamical processes. The programme is executed by the Delft Center for Systems and Control (DCSC), a merging of three former systems and control groups of electrical engineering, mechanical engineering and applied physics. This Center is housed at the Faculty of Mechanical, Maritime and Materials Engineering.

It is the intention of the programme to bring together students from a variety of backgrounds in engineering, to study systems and control theory and engineering aspects of dynamical systems in wide-ranging application areas: from small-scale microsystems and mechatronics, to large-scale industrial production plants; from physical measurement systems in microscopy and aperture synthesis systems, to transportation systems in traffic and aerospace. The number of application areas that students can specialize in is abundant. The programme attracts numerous students, either with a background in one of the TUD BSc programmes, or students from abroad. The interesting and challenging programme provides top-quality expertise and skills for a successful professional career in either research, technology development, or any other professional environment.

The SC-Guide has been composed with care, trying to provide answers to the most common questions. For most up-to-date information, the reader is also referred to the website:
www.dcsc.tudelft.nl.

Suggestions for improving this guide are preferably sent to Ewoud van Luik, coordinator education, e.p.vanluik@3me.tudelft.nl.

Prof. Hans Klein Woud MSc, FIMarEST
Director of Education SC

Prof. Paul van den Hof
Chairman Education Committee SC

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MSc programme

1 MSc Systems and Control

1.1 Goal

The MSc programme Systems and Control is directed towards the analysis and design of reliable and high-performance measurement and control strategies for a wide variety of technological dynamical processes. It is centered around fundamental generic aspects of systems and control engineering, while in the considered application areas, it stresses the multidisciplinary character of the field, with applications in mechanical engineering, electrical engineering, applied physics, aerospace engineering and chemical engineering, among which

- High-accuracy positioning and motion control systems, mechatronics, microsystems, production systems, robotics and smart structures;
- (Petro)chemical/physical and biotechnological production processes
- Transportation systems (automotive systems, logistic systems, aerospace)
- Physical imaging systems (acoustic and optical imaging)
- Energy conversion and distribution
- Biomedical systems

The programme brings together issues of physical modeling, experiment design, signal analysis and estimation, model-based control design and optimization, hardware and software aspects, in the scope of studying systems of high complexity and of different nature, such as linear and nonlinear dynamics, hybrid and embedded systems and ranging from small-scale microsystems to large-scale industrial plants.

The graduated Master of Systems and Control Engineering meets, to a sufficient level, the following qualifications:

1. Broad and profound knowledge of engineering sciences (electrical engineering, mechanical engineering, applied physics, mathematics) and the capability to apply this knowledge at an advanced level in the systems-and-control-engineering discipline.
2. Broad and profound scientific and technical knowledge of the systems-and-control-engineering discipline and the skills to use this knowledge effectively. The discipline is mastered at different levels of abstraction, including a reflective understanding of its structure and relations to other fields, and reaching in part the forefront of scientific or industrial research and development. The knowledge is the basis for innovative contributions to the discipline in the form of new designs or development of new knowledge.
3. Thorough knowledge of paradigms, methods and tools as well as the skills to actively apply this knowledge for analysing, modelling, simulating, designing and performing research with respect to innovative technological dynamical systems, with an appreciation of different application areas.
4. Capability to independently solve technological problems in a systematic way involving problem analysis, formulating sub-problems and providing innovative technical solutions, also in new and unfamiliar situations. This includes a professional attitude towards identifying and acquiring lacking expertise,

monitoring and critically evaluating existing knowledge, planning and executing research, adapting to changing circumstances, and integrating new knowledge with an appreciation of its ambiguity, incompleteness and limitations.

5. Capability to work both independently and in multidisciplinary teams, interacting effectively with specialists and taking initiatives where necessary.
6. Capability to effectively communicate (including presenting and reporting) about one's work such as solutions to problems, conclusions, knowledge and considerations, to both professionals and non-specialised public in the English language.
7. Capability to evaluate and assess the technological, ethical and societal impact of one's work, and to take responsibility with regard to sustainability, economy and social welfare.
8. Attitude to independently maintain professional competence through life-long learning.

1.2 Educational Concept and Assessment

The master programme involves two major parts:

Lecture courses (60 EC)

These courses are divided in three parts:

- Compulsory part (24 EC)
- Elective part from a selective list of systems and control courses (at least 19 EC)
- Free elective part to be chosen in agreement with the MSc-Thesis supervisor (at least 17 EC). At least 4 EC should be directed towards non-technical courses.

Most courses are assessed by means of an oral or written examination.

Assignments (60 EC)

The assignments take place in the second year of the MSc-programme. In general the assignments are carried out individually.

The assignments may involve:

- An optional traineeship in industry or a project task defined in consultation with an external party (industry, research institute, etc.) of 14 EC. In case the MSc-thesis is performed in cooperation with and at the office of an external party this part of the programme may be combined with the MSc-thesis.
- Project work (seminars, project meetings, presentations) (4 EC)
- Preparation MSc-thesis project (literature survey) (14 EC)
- MSc-thesis project (42 EC, or 28 EC when combined with an industrial traineeship)

The assignments are assessed, on the basis of a written report and possible on an oral presentation.

The MSc-thesis project is the final assignment in the MSc-programme.
The student prepares this thesis as a report of his/her research project. The thesis work is evaluated through an oral presentation by the candidate and an oral examiniation before

an MSc examination committee composed of at least three scientific staff members, including the thesis supervisor. The examination committee may also include external examiners from research institutes or from industrial partners. In paragraph 1.5 the requirements for assignments are specified.

1.3 Study programme and general structure

Systems and Control offers a Master of Science course of two years. Each course year is divided in two semesters. Every semester consists of two periods. In this study guide, these periods will be referred to as 1A, 1B, 2A and 2B. A period consists of seven weeks of lectures, followed by two or three weeks in which tests can be scheduled.
For those subjects where written examinations are taking place, the student will get at least one opportunity per year to do a resit. Resits generally take place in the first period after the regular period for a certain examination. Resits for the tests given in period 2B are scheduled in the second half of August.

The study load of a course is expressed in European Credits. The study load for one study year is 60 EC. These EC give an indication of the weight of a certain part of the course. One EC involves approximately 28 hours of study. These 28 hours include all time spent on the course: lectures, self study, internship, assignments, examinations, etc.
European credits are according the European Credit Transfer System (ECTS). This system encourages acknowledgement of study results throughout the European Union.

1.4 Admission to the programme

There are several ways to be admitted to the MSc-programme Systems and Control. Usually the MSc-programme is a continuation of an academic BSc-programme. However the MSc-programme can also be entered after completing a BSc-programme of a polytechnic high school.
Admission to the MSc-programme is described in the following two subsections.

1.4.1 Academic bachelor degree

Entrance conditions to the MSc programme for students with an academic BSc degree are summarized in the following table:

BSc	Free admittance	Admittance after additional program (max. 30 EC)
Aerospace Engineering	X	
Applied Earth Sciences		X
Applied Physics	X	
Applied Sciences		X
Biomedical Technology		X
Chemical Engineering	X	
Civil Engineering		X
Electrical Engineering	X	
Marine Technology		X
Mechanical Engineering	X	
Technical Informatics		X
Technical Mathematics	X	

Academic BSc-degree Mechanical Engineering, Electrical Engineering, Aerospace Engineering (DUT, TUE, UT and IDEA-league)

Students holding an academic BSc-degree Mechanical Engineering, Electrical Engineering or Aerospace Engineering of a Dutch University of Technology (Delft, Eindhoven or Twente) or a University which belongs to the IDEA-league (ETH Zürich, Imperial College London or Technische Universität Aachen) can enter the MSc programme without selection.
A student in the BSc-programme is permitted to do examinations of the MSc-programme, if the examination committee approves. When the student has passed the propaedeutic examination and has a study result of the second and third year of at least 100 EC,

including the BSc-thesis, the student can be conditionally admitted to the MSc-programme to take part in examinations of a few MSc-courses. Final admittance is granted after completing the BSc-programme.

Academic BSc-degree Applied Physics, Technical Mathematics or Chemical Engineering (DUT, TUE, UT and IDEA-league)

Students in this category can enter the MSc-programme without selection. In order to enter the MSc-programme additional courses have to be taken. These courses are part of the elective courses in the Msc-programme.

Applied Physics and Technical Mathematics:

–	sc3020et	Control systems	6 EC

Chemical Engineering:

–	sc3020et	Control systems	6 EC
–	wb2310	Systems and Control Engineering	4 EC

The student can be conditionally admitted to the MSc-programme, when the propaedeutic examination is passed and at least 100 EC of the second and third year of the BSc-programme have been obtained. Final admittance is granted after completing the additional courses.

Other Academic BSc-degree from Technical University

The contents of the BSc-degree and study results of each candidate will be evaluated. The intake-coordinator of the examination committee is responsible for this selection. The selection procedure can result in:

- admission without additional requirements
- admission with additional requirements of no more than 14 EC. The additional requirements will be part of the elective courses of the chosen variant.
- admission with additional requirements between 14 and 44 EC. In this case 14 EC are part of the 120 EC of the normal MSc-programme and 30 EC at most are additionally required above the standard MSc-programme.
- no admission. The candidate has to obtain a relevant BSc-degree first. Within the BSc-programme, exemption for some courses is possible, depending on earlier education.

1.4.2 Bachelor degree of Dutch polytechnic high school (TH)

Candidates having a BSc degree from a Dutch TH-programme in Electrical Engineering, Mechanical Engineering, Applied Mathematics, Applied Physics or Aerospace Engineering can be admitted. A requirement is that the candidate has completed the TH-Bachelors programme within 4 years, with good results. The intake-coordinator of the Examination Committee is responsible for the selection of candidates. Candidates are admitted to the pre-MSc-programme. This means that both the pre-MSc-programme and MSc courses can be followed. Final admission to the MSc-programme is given after completing the pre-MSc-programme.
Courses of the pre-MSc-programme are given in Dutch.

The pre-MSc-programme is composed as follows:

Course code	Course name	Lecture hours	EC
wi2256th	Linear algebra for TH-students	2/2/4/0	6
wi1152th	Analysis for TH-students part 1	4/0/0/0	3
wi1153th	Analysis for TH-students part 2	0/4/0/0	3
wi1154th	Analysis for TH-students part 3	0/0/4/0	3
et3502	Stochastic processes	2/0/0/0	3
tn2545	Systems and signals	4/4/0/0	6
sc3020et	Control systems	3/3/0/0	6

In agreement with the MSc Coordinator other courses may be chosen according to the individual profile of the student and the schedule of the courses. The proposed upgrade programme has to be approved by the Examination Committee.

1.5 MSc-programme Systems and Control

1.5.1 Delft Center for Systems and Control (DCSC)

The MSc programme Systems and Control starts in September of 2003. It is operated by the Delft Center for Systems and Control (DCSC) within the Faculty of Mechanical Engineering and Marine Technology. DCSC is a merging of the three former systems and control groups in the faculties Mechanical Engineering and Marine Technology (OCP), Information Technology and Systems (ITS) and Applied Sciences (TNW). See also the website of the Center: www.dcsc.tudelft.nl.
In DCSC there are three full-time professors, two Van Leeuwenhoek-professors and one part-time professor. For each of the MSc students one of these professors will act as the formal MSc-thesis advisor.

- prof.ir. O.H. Bosgra
  Modeling, identification, control and model-based optimization; applications in mechanical servo systems and industrial production processes.
- prof.dr.ir. P.M.J. Van den Hof
  Model-based measurement and control, system identification, signal processing and data-based control; applications in physical imaging systems, microsystems and industrial production processes.
- prof.dr.ir. M.H.G. Verhaegen
  Identification, model-based and fault-tolerant control; nonlinear, hybrid and embedded systems; applications in transportation, automotive, robotics and microsystems, power systems and switching networks.
- prof.dr.R. Babuska
  Intelligent modeling, control and decision-making for nonlinear dynamical systems; fuzzy control and neural networks; applications in industrial processes, biotechnology and aerospace systems.
- prof.dr. C.W. Scherer
  Fundamental aspects of systems and control theory, robust and multi-objective optimization, modeling and control of uncertain linear and nonlinear systems with applications to mechanical servo and microsystems.
- prof.dr.ir. J. Hellendoorn
  Hierarchical and predictive/anticipative control and decision making, computational intelligence (fuzzy logic, neural networks), traffic applications, condition monitoring.

In consultation with the MSc-students advisor, the MSc student chooses a MSc-thesis project out of the list of available projects that is advertized on internet. Each of the MSc-thesis projects will list the daily advisor that will coach the student throughout the project. Generally the MSc-thesis project will be performed in the scope of one of the ongoing research projects of the Delft Center for Systems and Control. Alternatively, MSc-thesis projects can be chosen in cooperation with one of the following affiliated research groups that participate in the MSc-programme.

1.5.2 Affiliated research groups

The following research groups are affiliated with the MSc programme Systems and Control. In joint projects with DCSC, students can participate in ongoing research projects within and/or in cooperation with these groups.

- 3mE/AM – **Advanced Mechatronics** www.3me.tudelft.nl/am
  Design, instrumentation and control of mechatronic systems, with applications in high–precision motion control systems as used in e.g. IC–production machines and selected micro–system applications.

- 3mE/MMS – **Man–Machine Systems** mms.tudelft.nl
  Interactions between humans and the technical systems they control, with applications in supervisory control of (industrial) processes, ergonomic design of technical systems, robotics and biomedical engineering.

- EWI/CROSS – **Mathematical System Theory**
  Basic systems and control theory, including dynamic game theory, digital control, robust control, systems subject to constraints and discrete event and switching systems with applications in e.g. traffic control systems.

- LR/CS – **Control and Simulation** www.cs.lr.tudelft.nl
  Modeling, identification, simulation and control of aircraft and spacecraft systems, including flight testing and air–traffic management.

- TNW/DCT – **Process Systems Engineering** www.dct.tudelft.nl/pse
  Integrated design, control and optimization of sustainable chemical processes.

- TNW/BT – **Bioprocess Technology** www.bt.tudelft.nl/bpkf.htm
  Modelling, measurement and design of bioprocesses; dynamic optimisation of fermentation processes and environmental biotechnological processes; systems Biology, metabolic Engineering

- CiTG/TPE – **Dynamic Traffic Management** www.transport.citg.tudelft.nl
  Modeling, simulation, monitoring, control and dynamic management of road, railway and pedestrian traffic.

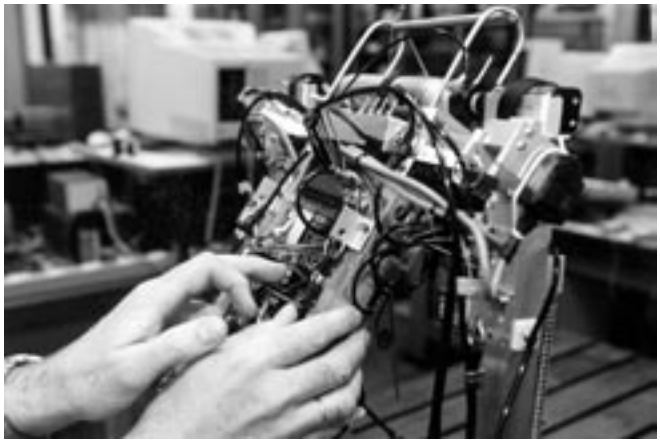
As a third option, MSc-thesis projects can be performed outside of the University, in the scope of one of the ongoing cooperative research projects between DCSC and partners in industrial companies and research institutes.

Relation with national graduate school DISC

The M.Sc.-program is an excellent preparation for the Ph.D.-program of the national graduate school DISC (Dutch Institute of Systems and Control) which resides at this same research center of Delft University of Technology.

1.5.3 Course program

The compulsory part of the course programme as listed in the next table, is composed of 3 basic courses, directed towards principal areas of the systems and control field: modelling and dynamic systems analysis, signal analysis en filtering, and control theory. Additional two project-type components are included. First an introductory project in which the basis knowledge and skills in systems and control, including the required background in math and engineering subjects, are refreshed and brought to the same level for all incoming students. Secondly an integration project that is performed in the laboratory, in which the acquired knowledge from the compulsory courses is confronted with real world applications.



1st year

Compulsory System & Control courses

Course code	Course name	Lecture hours	EC
sc4010	Introduction project SC	x/0/0/0	3
sc4020	Control theory	4/0/0/0	6
sc4031	Modeling & system analysis	0/3/0/0	4
sc4040	Filtering & identification	0/4/0/0	6
sc4050	Integration project SC	0/0/0/4	5
		Total	**24**

Elective System & Sontrol courses (19 EC to select)

Course code	Course name	Lecture hours	EC
DCSC-courses:			
sc4060	Model predictive control	0/0/3/0	4
sc4080	Knowledge based control systems	0/0/3/0	3
sc4090	Optimization in systems and control	4/0/0/0	3
sc4100/wb2414	Mechatronical design	2/2/0/0	3
sc4110	System identification	0/0/4/4	5
sc4120	Special topics in signals, syst. and contr.	0/0/0/2	3
sc4130	Modern robotics	0/0/4/0	4
sc4150	Fuzzy logic and engineering applications	3/0/0/0	3
sc4160	Modeling and control of hybrid systems	0/0/4/0	3
wb2303	Measurement theory and praxis	0/0/2/2	3
wb2305	Digital control	0/4/0/0	3
wb2400	Process control	0/0/2/2	3
wb2402	Hydraulic servo systems	2/2/0/0	3
wb2413-04	Instrumentation in the process industry	0/0/0/4	2
wb2415	Robust control	0/0/4/0	6
wb2416	Linear matrix inequalities in control	0/0/0/4	6
wb2421	Multivariable control systems	0/4/0/0	6
wb2426	Chemistry and chemical plant	0/0/2/2	3

Course code	Course name	Lecture hours	EC
Courses offered by affiliated groups:			
ae3302	Flight dynamics 1	2/2/0/0	4,5
ae4301	Automatic flight control system design	0/4/0/0	3
ae4305	Spacecraft dynamics and control	0/4/0/0	3
ae4361	Flight simulation	0/0/0/4	3
ce3511	Modeling and computational methods in process technology	0/0/2/2	4
ct4801	Transportation and spatial modelling	10/0/0/0	6
ct4821	Traffic flow theory and simulation	0/0/8/0	4,5
ct4822	Dynamic Traffic Management: Traffic control	0/8/0/0	4,5
ct5804	ITS Dynamic road management	4/0/0/0	3
et4245wb	Electro mechanical systems	0/0/0/3	4,5
lm3511	Systems biology	0/0/3/3	6
wb2427	Predictive modelling	0/0/4/0	3

Course code	Course name	Lecture hours	EC
wi4039	System theory	0/0/3/0	6
wi4040	Optimal control	0/0/4/0	6

DISC—courses:
For a list of courses offered by the Dutch graduate school on Systems and Control (courses taught on Mondays in Utrecht) see the current DISC programme available at www.disc.tudelft.nl.

13 EC can be taken from other technical courses, with the approval of the MSc-coordinator advisor.
Maximally 10 EC of this category can be chosen from the list of elective System & Control courses.

4 EC should be directed towards non-technical courses.

Profiles

To facilitate the choice of elective DCSC courses, the subsequent list provides an indication of how they could be distributed over the following four profiles

A) Systems and Control Theory
B) Mechatronic Systems
C) Process Control and Optimization
D) Information Technology and Control

A	B	C	D	Code	Course
•		•	•	SC4060	Model predictive control
		•	•	SC4080	Knowledge based control systems
•		•	•	SC4090	Optimization in systems and control
	•			SC4100	Mechatronic design
•	•	•		SC4110	System identification
•				SC4120	Special topics in signals, systems and control
	•			SC4130	Modern robotics
•			•	SC4150	Fuzzy logic for engineering applications
•			•	SC4160	Modeling and control of hybrid systems
	•			WB2303	Measurement theory and practice
	•	•	•	WB2305	Digital control
		•		WB2400	Process control
	•			WB2402	Hydraulic servo systems
		•		WB2413	Instrumentation in the process industry
•	•			WB2415	Robust control
•				WB2416	Linear matrix inequalities in control
•	•	•	•	WB2421	Multivariable control
		•		WB2426	Chemistry and chemical plant
	•			WB3404A	Vehicle dynamics A

Courses in A) put a particular emphasis on the fundamentals in systems and control with an explicit orientation towards research. Courses in B) and C) are suited for developing expertise concerning control systems in two conceptually different application domains. Courses in D) are directed towards the relation of control with information technology. This distribution is only meant to provide orientation for the composition of an individual course program and does in no way impose any formal restrictions.

1st year

Courses	EC
Compulsary	24
Electives Systems & Control	19
Other technical electives*	13
Non technical electives	4
Total	**60**

* Max. 10 from list of elective Systems & Control courses

2nd year

Part	EC	
Project work (seminars, project meetings, presentations)	4	4
Preparation MSc-thesis project (literature survey)	14	14
MSc-thesis project	42	28
Internship (optional)	0	14
Total	**60**	**60**

In case of a internship the MSc-thesis project is reduced to 28 EC.

In order to enter the MSc-programme the student should compile a list of courses, which should be approved by the MSc-coordinator. This list should be filled in at a form, which can be acquired from the MSc-coordinator and at the website.

1.5.4 Annotation Sustainable Development

As an addition to the variant programme the annotation Sustainable Development can be done. After completing the annotation, the student gets a supplement to the MSc-degree, which declares a more than average knowledge about that subject. The study programme, including the annotation, has to comply with the requirements of paragraph 1.2 (120 EC).

Sustainable Development (SD) is a growing concern in many research projects and is becoming a more essential element of political and organisational decision making. Nowadays technology plays an important role in the approaches to sustainability related problems. For this reason the Delft University of Technology offers students the possibility to specialise in SD.
The annotation tackles both the broad and in-depth knowledge regarding SD and technology. Sufficient in-depth knowledge is realized with the MSc-thesis, which has to incorporate SD issues. Students make SD a central element in the thesis focussed on their own disciplines. Every faculty has a SD lecturer, with specific expertise to assess the thesis. The broad knowledge is guaranteed through the colloquium 'Technology in Sustainable Development' (wm0922tu, 4 EC) and a number of elective courses in the field of SD (at least 11 EC).
(Based on flyer 'What's your contribution to a sustainable world?'.)
Further information on the available courses can be obtained at the website

http://www.odo.tudelft.nl and from dr.ir. Ton van den Boom, (MSc coordinator), Location 8C, 3rd floor, room 09, Phone: 015 27 84052, Email: t.j.j.vandenboom@dcsc.tudelft.nl.
For enquiries concerning the colloquium and enrolling: Gertjan de Werk, g.dewerk@tbm.tudelft.nl.

1.5.5 Technical University Teacher Course (TULO)

Graduated Masters of Science Systems and Control, Mechanical Engineering or Maritime Technology have the opportunity to participate in a special course to become a high school teacher in science or mathematics.
There is a standard course, which includes 60 EC. A maximum of 30 of these EC can be integrated in the MSc study programme, the other, at least, 30 EC have to be earned in a post MSc course.
For more information on admission to the programme and the study programme please contact the office of TULO.

Office of TULO
faculty TBM
Jaffalaan 5, 2628 BX Delft.
Phone: 015 27 82786 / 015 27 83768
E-mail: j.geerlings@tbm.tudelft.nl

1.6 Enrolling for courses and tests

Usually it is necessary to enroll for courses and tests.

Courses Students can enroll for specific courses at Blackboard. Most of the communication between lecturer and students goes by blackboard announcements. Also exchange of information, assignments and reports often takes place via at Blackboard.

Tests Enrolling for tests is compulsory and can be done at the TAS-site ('Tentamen Aanmeld Systeem' http://www.tas.tudelft.nl). This should be done two weeks before the test takes place, at the latest, otherwise the test will not be accounted for by the lecturer. If a student has enrolled, but decided not to do the test, the student must cancel this, at least one week before the test takes place.

Using TAS When first using TAS the student must choose a personal password. This can be done by using the campus card in a card reader. At the faculty there are two card readers: one is located near the Pallas / Parthemus computerroom (4, 1st) and one is located at Education support staff (8B, 2th).

1.7 Pass rules and criteria for 'honours-degree'

Pass rules To pass a course or assignment, a grade of at least 6,0 is necessary. It is possible to pass the MSc- examination with one grade of 5. The grades are rounded off to the nearest integer.

Examination On completing the programme, the student should apply for the Master's examination by means of a form, available from the Education Support Staff or the website.

'honours- degree' The 'honours-degree' is granted to graduates with the following study results:

- Grade average, excluding the MSc-thesis, is at least 8.
- No grades lower than 6.
- Grade for MSc-thesis is at least 9.
- Not more than 3 years to complete the MSc-programme.

This is a summary from part of the "Regulations and guidelines for the board of examiners", appendix 6.1 of this studyguide.

1.8 Honours Track

For excelent students it is possible to follow an honours track. An honours track is a special individual programme, in addition to the regular Master programme, of 30 EC (840 hours) and is related to Systems and Control Engineering and / or to the role of technology within society. The extra programme has to be finished during the Master programme of the student. Students who have successfully completed their honours track receive a special certificate of the university. Students, who have finished the Bachelor programme with a weighted averaged mark of 7.5 or higher and students who have shown an excellent performance during the first semester (no fails and weighted averaged mark 7.5 or higher), are eligible for following the honours track in their Master programme. The Director of Education is responsible for the programme of each individual honours track.

1.9 Study and internship abroad

Study abroad offers a lot of attractive prospects. You become acquainted with a different (organisational) culture, a different university life and a different educational system. Besides you enlarge your personal network, you learn to live within a foreign environment, and you improve your knowledge of languages. To put it briefly: a period of study abroad will make a valuable contribution to your personal education and you will draw much benefit from it at your search for a proper job.

You can make use of one of many exchange agreements with European and non-European universities for your study at a foreign university. Within such an agreement you do not pay the foreign university any tuition fee. In addition to this, grants are available for financing the additional expenses for staying abroad. For your first information on

studying abroad it is recommended to visit the Back Office International Programmes of the Student Facility Centre. Much documentation about study abroad is available at this Centre, like information on all universities with which an exchange agreement exists, possibilities of financing, and travel reports from students.
If you got a clear idea about where you want to go to, you can ask the Coordinator for International Exchange Marine Technology for advise about your programme at the foreign university and about the recognition of your results at the host university. Your graduation professor will judge your work afterwards according to the rules you agreed upon, prior to departure.

The foreign programme should at least contribute 12 EC to your MSc programme.
To arrange everything you have to do a lot yourself. Therefore you have to take a preparation period into account of preferably a year, but at least half a year.

Internship

Usually a internship is arranged via one of the staff members of the section to which your specialization belongs. In addition to this you can visit the Information Centre of the Student Facility Centre (see above). They offer a lot of information, not only on a large number of companies abroad, but also on financially related affairs, working permits, visa, etc.

Additional information on both study and internship abroad is available at the TUDelft website (http://www.tudelft.nl); via Campus Portal choose under the heading STUDENT AFFAIRS: 'Internship, study, jobs'.

International Coordinator 3mE
Mw. M.P.I. Toppenberg
Room 8C, ground floor
Mekelweg 2
2628 CD Delft
Tel.: +31 15 278 6959
Fax.: +31 15 278 8340
E-mail: m.p.i.toppenberg@3me.tudelft.nl

1.10 Profile of the Systems and Control Engineer

MSc graduates find their jobs in nearly all branches of industry, in management, design office, research, development or technical department. An increasing number of engineers plays a role in giving advice on, and selling high-grade products and capital-intensive equipment. In our technologically highly developed society government bodies constantly need people with a technical-scientific education, i.a. for policymaking. In scientific education too mechanical engineers have their jobs.
The combination of broad technical-scientific BSc-programme and large choice of specialisations within the MSc-programme give the Systems and Control engineer from Delft a versatile employability. This versatility is illustrated by the variety of professions, among which there are: designer, scientific researcher, organization expert and automation consultant. Many engineers occupy management positions within a short period: between 25 and 30 % lead a team of 5 to 6 persons in average within about one year.

1.11 Cheating, Citation and Plagiarism

When doing an assignment, project or other educational activity, the student uses sources and knowledge of other people. This is allowed if the following points are taken in mind:

Citation Citation, literaly copying text is allowed, if:
- The text is limited in length and
- the citation is made between quotation marks and
- the source, even when this is an internet source, is mentioned in a correct and complete manner.

Parafrasing Parafrasing means describing a text of a third party in your own words. This is allowed, if:
- It is mentioned what is being copied and of whom and
- the source, even when this is an internet source, is mentioned in a correct and complete manner and
- there is a clear seperation between the ideas of the third party and own ideas.

Plagiarism Plagiarism means copying of pieces of text, ideas, design and theories of others, without mentioning the source. Plagiarism is a form of cheating and is illegal.

Cheating Passengers Cheating is wider than plagiarism and also includes taking a look at other's work during exams or refusing to make an proportional amount of effort in a group assignment, which is assessed based on the effort of the group as a whole. People, who do this are called passengers.
Students suspected of copying, cheating, or being passengers, run the risk of being barred by the examination board from all tests and examinations held by TU Delft for up to one year. This can also have wide-ranging consequences for both the duration and the financial aspects of your course of study.

(With information from the TBM flyer 'Copying is a copout')

Organisation

2 Organisation

2.1 Faculty

The faculty 3mE offers the study programmes Biomedical Engineering (BME), Materials Science and Engineering (MSE), Mechanical Engineering (ME), Marine Technology (MT), Systems and Control (SC) and Offshore Engineering (OE). The faculty also participates in the interfaculty MSc programme Transport, Infrastructure and Logistics (TIL).
3mE is an abbrevation of Mechanical, Maritime and Materials Engineering.
The organisation of the faculty and the structure of the educational and board of examiners of the faculty are described in the faculty regulations. The dean has the final responsibility for the faculty. He is assisted by the Director of Education. Together with the department heads they form the management team. The dean is supported by the Faculty Staff and is advised by a number of advisory boards.

Dean Prof.drs. M. Waas, room: 8F-1-14, phone: 015 27 85401, email: m.waas@3mE.tudelft.nl

2.2 Delft Center for Systems and Control

The MSc programme Systems and Control is executed by the Delft Center for Systems and Control. This Center is part of the Department Mechatronics and Control of the Faculty of Mechanical Engineering and Marine Technology. In this Center research and teaching in the areas of systems and control theory and engineering is concentrated, giving attention to both fundamental research on systems and control theory issues and to high-tech applications. Besides this MSc programme, the Center participates in other BSc and MSc programmes of the TUD, among which Mechanical Engineering, Electrical Engineering, Applied Physics and Chemical Engineering.
In the Center there are working 5 full and 1 part-time Professor, 13 Assistent/Associate Professors, 15 Technical support staff and 30 PhD-students.
The Center is housed at the floors 0, 2 and 3 of building 8C (the block left of the main entrance), as well as floor 2 of building 5. Its laboratory can be found on floor 0 of building 5.

Managament	prof.dr.ir. Paul M.J. Van den Hof	8C-2-8	84509	p.m.j.vandenhof@dcsc.tudelft.nl
	prof.dr.ir. Michel H.G. Verhaegen	8C-2-25	85204	m.h.g.verhaegen@dcsc.tudelft.nl
	prof.ir. Okko.H. Bosgra	8C-3	85610	o.h.Bosgra@dcsc.tudelft.nl
Secretary	Mrs. Ellen van den Berg-Moor	8C-2-7	82473	info@dcsc.tudelft.nl

2.3 Education support staff

The education support staff is executing the education support of the study Systems and Control. For all issues related to the Systems and Control study the students can get information.

prof.ir. Hans Klein Woud	Director of Education	j.kleinwoud@3me.tudelft.nl	Tel. 015 27 81556
ir. Nic-Jan van Bemmel	Manager Educational Programmes	n.j.vanbemmel@3me.tudelft.nl	Tel. 015 27 88791
Fatma Çinar	Education Administration office	f.s.cinar@3me.tudelft.nl	Tel. 015 27 86753
Teuni Eden	Student adviser	t.eden@3me.tudelft.nl	Tel. 015 27 82176
Lies Gesink	Education Administration office	e.g.gesink@3me.tudelft.nl	Tel. 015 27 86591
Louise Karreman	Study Administration office	l.m.karreman@3me.tudelft.nl	Tel. 015 27 83457
Ewoud van Luik	coordinator education	e.p.vanluik@3me.tudelft.nl	Tel. 015 27 85734
dr. ir. Dick Nijveldt	Educational Adviser	d.nijveldt@3me.tudelft.nl	Tel. 015 27 85921
Carel Piguillet	Software Support	c.f.f.piguillet@3me.tudelft.nl	Tel. 015 27 86820
ir. Jaap v.d. Zanden	Student adviser	j.vanderzanden@3me.tudelft.nl	Tel. 015 27 82996
Mascha Toppenberg	International MSc-coordinator	m.p.i.toppenberg@3me.tudelft.nl	Tel. 015 27 86959

Education Support Staff
Mekelweg 2, 2628 CD Delft
Location 8C, ground floor
Phone: 015 27 86959 / 015 27 83457
Fax: 015 27 88340

2.4 Education committee

The education committee advises the dean and the education director on the contents and the structure of de study programme and the examinations.
The education committee exists of four lecturers and four students. Also the education director, the education adviser and a student adviser take part in the meetings.

Chairman prof.dr.ir. Paul M.J. Van den Hof
room 8C-2-8
Mekelweg 2
2628 CD Delft
phone: 015 27 84509 / 82473 (secr)
e-mail: p.m.j.vandenhof@dcsc.tudelft.nl

Secretary Mrs. Ellen van den Berg-Moor
room 8C-2-7
Mekelweg 2
2628 CD Delft
Phone: 015 27 82473
e-mail: n.vandenberg@dcsc.tudelft

2.5 Board of examiners

The board of examiners consists of all lecturers, involved in the study programme, as mentioned in paragraph 1.5.
The board of examiners is responsible for the rules and regulations of the examinations and the assessment of the examination results. Requests can be addressed to the board of examiners for participating in a deviating study programme.

Chairman
prof.dr. Carsten W. Scherer
Mekelweg 2,
Location 8C, 2nd floor, room 22
phone: 015 27 85899
e-mail: c.w.scherer@dcsc.tudelft.nl

Secretary
E.P. van Luik
Mekelweg 2
Location 8C, ground floor
phone: 015 27 85734
e-mail: e.p.vanluik@3me.tudelft.nl

2.6 Students association

'Verstelregel' is the students association of students Systems and Control at the TU Delft. Its aims are to bring students and staff closer together, help future Msc. students to get in contact with the group, organize lunches, excursions to companies and research institutes and sport events. The VerstelRegel is led by a board which currently consists of four MSc students. The members of the board can be contacted by email: verstel@control-lab.et.tudelft.nl, through the webpage: http://verstelregel.gigaglas.nl and also via the secretariat of the goup.

2.7 Student guidance

2.7.1 MSc coordinator

The MSc coordinator is the person for questions or problems related to Individual study programme and monitoring.

Every student should contact the MSc coordinator at your earliest convenience, but certainly before the end of the first semester. In agreement with the MSc coordinator, the student sets up an individual study programme using the following ingredients: compulsory courses, your current ideas about the theme of the thesis project, the specialisation courses that bridge the gap between the compulsory courses and the thesis project and your use of the free elective space.
In order to finish the programme in two years, the student should plan to take an average of 30 credits worth of courses per semester. At the end of the first semester, the student and the MSc coordinator will discuss the progress and performance. The student submits his/her plan for approval to the Examinations Board at the start of the second semester.

dr.ir. Ton van den Boom
MSc coordinator
Mekelweg 2
Location 8C, 3rd floor, room 09
Phone: 015 27 84052
Email: t.j.j.vandenboom@dcsc.tudelft.nl

2.7.2 Student guidance

For assistance and advise to students the faculty has two student advisers. The student adviser is the person for questions or problems related to the study or about issues, which may influence the ability to study. The student adviser functions as oracle (vraagbaak) and as confidential consultant to students.

Individual help and advice
The student adviser has no educational responsibilities and can, therefore, devote himself totally to individual students and to help solving their problems which may be an obstacle to their study progress. He also takes seat in a lot of boards and has contact with the lecturers, so that he has up to date information about what is going on in the study Mechanical Engineering. He also has contact with other student advisers and personal advisers at the TU Delft and outside the University; so he knows what is going on elsewhere.

Personal circumstances
During a talk with a student adviser, often intimate information comes up. The student can be sure that this information will be dealt with confidentially. This kind of information will only be used after consultation with the student, to plead to apply TU- or faculty regulations.

Advice to Examination Committee
A student adviser can decide, as result of certain conditions, to advise e.g. the board of examiners, in favour of a specific student. When necessary the student adviser becomes an intermediary between TU Delft personal advisers: student, deans, psychologists and physicians. The amount, in which the student adviser pays attention to a student, is up to the student. The student adviser keeps an eye on the study progress of most of the students and calls up one when necessary, but it is strongly recommended to contact the student adviser yourself when a question or problem comes up. Waiting often results in an increase of the problem. The two student advisers at the faculty are available for all questions. They also have their own specialisms.

Foreign Student Financial Support (FSFS)
The Delft University of Technology provides financial assistance to foreign students in cases where their study suffers delay due to special circumstances like physical illness, physical or sensory disorder, mental problems, insufficient organisation of the educational programme by the faculty.

Mrs. Teunie Eden, student adviser for all students BSc-MSc WbMT, as well as counsellor in case of harassment (see down this page)
Specialisms: Exchange students, International MSc-students, social programme international students.
Mekelweg 2, 8B 2th floor, room 28B
Email: t.eden@3me.tudelft.nl
Phone: 015 27 82176

Ir. Jaap v.d. Zanden, student adviser for all students BSc-MSc 3me.
Specialisms: Graduate students, polytechnic high school students, quality control, student mentors.
Mekelweg 2, 8B 2th floor, room 28A
Email: j.vanderzanden@3me.tudelft.nl
Phone: 015 27 82996

Dyslexia
Students having dyslexia usually have problems with reading and understanding of long texts. This can be an obstacle to 'normal' study progress. Therefore these students are advised to contact one of the student advisers and to set up a remedial plan. Important issues are:

- A planned study delay often helps
- When necessary, longer time for tests is possible
- Studying with a fellow student often results in more study progress
- IBG has extra student grants

2.8 Working conditions, RSI and harassment

RSI (Repetitive Strain Injury) is a well known problem by now. Within the TU Delft the number of complaints caused by RSI is increasing. Still too many employees and students neglect the first symptoms of RSI, without knowing where to go with their questions and complaints. On the internet there is a lot of information to be found on this matter. An example is http://www.rsi.pagina.nl.
Free software, can be downloaded on the WbMT website, that helps you to prevent RSI: http://www.3me.tudelft.nl, button: "facilities".

Causes

There are two mechanisms that cause RSI:

- Dynamic loading: repetitive dynamic loading of muscles in fingers and hands, without taking breaks, can cause an overload in these muscles. Friction between muscles, tendons and bones can eventually cause damage.
- Static loading: constant stressing of muscles in the neck, shoulders and arms prevents blood circulation and squeezes off nerves. This results in cold and tingling fingers. Mental stress and unfavourable positioning of the body increases this effect.

Symptoms

There are various symptoms, which indicate RSI: pain, stiffnes, tingling and a loss of strength can occur in neck shoulders, arms, wrists, hands and sometimes even in legs. Wtihout resting these symptoms will only get worse.

Prevention

How to prevent RSI:

- Vary repetitive tasks, like typing and using a mouse, with non repetitive tasks, like walking to the printer or reading documents.
- Take regular breaks. It is recommended for every two hours work to take a 10-minute break and for every 10 minutes work to take a 20-second break, to improve blood circulation. It is even better to do exercises, within these breaks. For this purpose anti-RSI-software can help.
- It is strongly disrecommended to do more than six hours of computer work a day.
- Make sure that the working position of the body is correct. A good installed workplace is important for a correct working position. Sit straight in front of your monitor and keyboard. The height and distance of the monitor and desk should be sufficient. A chair with a convex back at waist height is favourable.
- Try not to work under stress caused by deadlines or private problems.

Don't neglect the symptoms of RSI. For questions you can contact the following people:

- Student adviser
- Labour and environmental adviser Leen Paauw, l.paauw@3me.tudelft.nl
- Student Health Care (SGZ), tel: 015 2121507, studentenartsen@sgz.nl
- Student Facility Centre (SFC), http://www.sfc.tudelft.nl
- VSSD support, tel: 015 27 82057, http://www.vssd.nl

Harassment
Harassment is inappropriate, unwanted behaviour which disturbs someone. Teasing, mocking, gossiping, bullying, sexual or racial intimidation, violence and discrimination are all forms of harassment.

Counsellor

If you have problems you can turn to the Counsellor as appointed by each department within the university. Counsellors operate under strictly confidential and trustworthy conditions and can offer advice, information, support and assistance to victims of harassment. When necessary they may enlist the assistance of mediators. They can also assist and guide you, should you wish to submit your complaint to the DUT Complaints Committee. All actions are subject to your permission and approval.

If you experience any problems do not hesitate! Everyone at TU Delft has a right to feel respected and safe!

The Counsellor for our department is:
Mrs. T.Eden
Mekelweg 2, 8B 2th floor, room 28B, email: vertrouwenspersoon@3me.tudelft.nl
Phone: 015 27 82176

2.9 Quality Control

The quality of the education is continuously monitored and evaluated. This is done by the faculty itself and by external organisations. The results of the evaluations are public. A summary of these results can be found on the internet.
Based on these results the education committee and the education director advises the dean.

Internal Quality Control:

Course Evaluation

- To evaluate the opinion of the students a "**course-evaluation-system**" exists. This system gives all students the opportunity to give their opinion on the education. The study programme and courses are evaluated each year by means of a questionnaire
- **Evaluation meetings** with students and lecturers.

Complaints

- Submitting and dealing with **complaints**. These complaints can be lodged at the students association or at the education director.
- The faculty evaluates itself regurlarly in a self-assessment.

External quality control:

- The study is being accredited every five years, by the NVAO (Nederlands Vlaamse Accreditatie Organisatie). In preparation of the accreditation, the study is evaluated y a visitation committee formed by QANU (Quality assurance Netherlands Universities)

2.10 Information services

Study guide

This study guide is the main information source of the study programme and is available to all students at the education support desk (8B, 2th).

Blackboard

The website, however always contains the most recent information. Announcements, which are of importance for the study, like changes in the schedules, are made timely on the homepage of the faculty and at Black Board.

Grades

Schedules about the lectures, assignments and examinations are available at the desk of the study administration. At the homepage of the faculty and Black Board the changes in these schedules are given. Grades can also be found on blackboard.

Information that is not related directly to the study e.g. information by students association 'Leeghwater, will be published on publication boards. Members of 'Leeghwater' will be kept informed by e-mail.

2.11 Rules and Regulations

Student Statute (Studentenstatuut)

The Education Specific Part of the Student Statute (OSDS) applies to the education and the examinations of the study Marine Technology.

The OSDS defines which educational services are given by the faculty and what is demanded from the students. The OSDS intends to offer the students an easy way to accomplish improvements in the educational situation, with help of the education director.

The OSDS consists of:

- This Study Guide.
- The Course and Examination Regulations for the study Marine Technology (CER, see appendix 6.1).
- Implementation Procedures (appendix 6.2).
- Regulations and guidelines for the board of examiners (appendix 6.3).

Faculty regulations

- It is not allowed to smoke within the faculty building.
- Students have to follow the instructions given by staff members. Staff members are those who support or give lectures and those who are responsible for buildings and the surrounding areas.
- On the first demand of a staff member the student should identify him- or herself by showing the campus card.
- The student should be present in time, before the start of a lecture, assignment, instruction or meeting. The lecturer or assistant may reject students who are late.
- Regular times for lectures to start are:

Lecture	Start	End
1st hour:	8.45	9.30
2nd hour:	9.45	10.30
3rd hour:	10.45	11.30
4th hour:	11.45	12.30
5th hour:	13.45	14.30
6th hour:	14.45	15.30
7th hour:	15.45	16.30
8th hour:	16.45	17.30

- Bikes should be placed in the bike stands provided.
- There is an opportunity to store personal belongings in lockers which are provided in the main hall. In the corridor situated next to lecture rooms A till F, bigger lockers can be used to store helmets. At the end of the study year, before the 15th of July, the lockers should be empty and the keys should be returned. Lockers, still in use after the 15th of July, will be provided with a new lock on cost of the student.
- Eating and drinking is only allowed in the canteen, the coffee corner and in the immediate surroundings of a soda, candy, coffee or soup dispensers.
- Writing on, drawing on, sticking things on or scratching in furniture, walls, doors or windows is prohibited.
- Garbage and paper should be disposed in bins.
- For the use of computers, network connections, printers and plotters there are rules and regulations, which should be taken in consideration.
- Disobeying of rules and regulations can result in a suspension or a denial of certain facilities. Theft or destruction on purpose of properties of DUT and also serious misbehaviour will be mentioned to the proper authorities.

Internet facilities

The of internet facilities at the faculty is bound to some regulations:

It is allowed to:

- Send e-mail to persons (or applications) from which can be expected that they will not consider the e-mail as annoying. Also you can receive e-mails which can be temporary stored in the inbox.
- Read online magazines and to place articles in it.
- Use the network information services like WWW-servers and FTP-servers, which are in use at this moment and also which will become available in the future. All use of services is bounded by regulations.
- Use the "Intranet DUNeT" on telephones provided through the faculty.

It is not allowed to:

- Damage or disable facilities.
- Use available facilities in any other way as they were supposed to be used:
  - Downloading, uploading and filesharing of copyright protected items, such as texts, audio and video files, in any format.
  - Downloading and installing any applications on the faculty computers.
  - Playing computer games using network facilities.
- Make excessive use of the facilities.
- Let a third party use available facilities (including fellow students).
- Do damage or obstruct other users or equipment linked to the world wide web.
- Disrespect other peoples privacy, for example by sending information under a false name.
- Become member of a mailing list outside the faculty without permission of the "dutwmail director". This rule only applies to the students.
- Distribute or show material that can be regarded as offending, for example insulting phrases or pornographic images or movies.

Sanctions:

- Account deactivation immediately after a violation has occurred.
- In case of serious violation and in case of repeated violation: prohibition of the use of ICT facilities, up to a year.
- In case of law violation: notification to the police.
- All claims, as a result of violations, are passed to the violator.

Facilities

3 Facilities

In this study guide is being referred to locations, within the faculty building, by means of a number and a letter between brackets, which corresponds to the faculty map in appendix 6.7. The floor is also indicated (BG= ground floor, 1st = first floor, etc.). Locations outside the faculty can be found at the campus map, appendix 6.5.

3.1 Lecture Rooms / Meeting Rooms

Lecture rooms are used for lectures, presentations and instructions. The next table summarises all lecture rooms, mentioning capacity and location.
Meeting rooms are available for meetings, discussions etc. of small groups of students. Reservations can be made as the desk of the education support staff.

Room	Capacity	Location
A	300	6, BG
B	200	6, BG
C	150	6, BG
D	150	6, BG
E	70	6, BG
F	70	6, BG
J	50	8D, 1st
K	30	8G, 1st
L	30	8G, 1st

3.2 Individual study facilities

At several locations in the faculty individual study places are available. Some of these study places are equipped with computers. These places are free to use, without reservation. Places should be left clean and tidy.
Besides the study places as mentioned above, there are also places to study in the faculty library and the central library (see 3.5). In the library students have to be silent. The same rules apply as for the study places.

3.3 Computer rooms

Besides computers at the study places, computers are available in the computer rooms. All computers give access to the internet. The computer rooms are free to use by all students, if they are not in use for instructions or assignments. When they are, the computer rooms are not accessible for everybody. A schedule, on the door of each computer room tells when these instructions or assignments take place. The next table shows all the computer rooms and their location.

Room	Location
Athena room	4, 1st
Parthemus room	4, 1st
Pallas room	4, 1st
Design studios	8G, BG

3.4 Research facilities

The faculty has a number of research laboratories. Students may perform a part of their study e.g. the MSc-Thesis or an laboratory exercise in these laboratories. The laboratories are used for research activities of Ph.D.- Students and staff.
The different laboratories are:

The laboratory of DCSC is situated in building 5A on the ground floor. Besides experimental setups it also provides office locations for MSc students. There are several experimental setups used for both teaching and research. All setups are provided with real-time control facilities in the form of either DS1102/3 interface cards from dSpace or with PCI-1711 interface cards from Advantech. Data acquisition and real-time control are implemented through Matlab/Simulink software.

Prototype flight simulation platform

For more information, contact the laboratory manager:
ing. John Seiffers
Mekelweg 2
Location 5, 1st floor, room 06
Email: j.seiffers@3me.tudelft.nl
Phone: 015 27 82996

3.5 Library

Central library

Prometheusplein 1
Postbus 98
2600 MG Delft
tel: 015 27 85678
fax: 015 27 85706
www.library.tudelft.nl

The library of the TU Delft consists of a main building and smaller faculty libraries . The main building has a large collection of books and magazines. The main part of the collection can be lent from the library and has to be requested. 30 minutes after requesting the item will be available. The remaining part of the collection (open shelves) is only available within the library.
The main building has more than 1000 study places (at the ground floor, on the different floors of 'the cone' and in a couple of group rooms), a computer room and coffee and candy dispensers.
To lend a book, a student needs a library card, which pass can be acquired at the desk in the main building or at the faculty libraries.

		Lecture period	Exam period	Summer holiday
Opening hours	Mo - Thu	9:00 - 22:00	9:00 - 24:00	9:00 - 17:00
	Fri	9:00 - 18:00	9:00 - 22:00	9:00 - 17:00
	Sa and Su	10:00 - 18:00	10:00 - 22:00	Closed
Book desk	Mo - Thu	9:00 - 19:00	9:00 - 19:00	9:00 - 19:00
	Fri	9:00 - 17:00	9:00 - 17:00	9:00 - 17:00
	Sa	10:00 - 13:00	10:00 - 13:00	10:00 - 13:00

Books can be borrowed for a period of 28 days. This term can be extended as long as no other person makes a reservation for the book. As a maximum, 20 items can be loaned. If a book is requested but not available, the requester will receive a notification by email or post if the book is available.
The central library is behind the auditorium (aula) at the Prometheusplein, see appendix 6.5.

Request

Searching and requesting books is possible by the online catalogue at http://www.library.tudelft.nl. This catalogue includes all collections of all libraries of the TU Delft. Besides the catalogue, requesting of books is possible at the desk of the central library.

Library card

In order to use the library facilities a student is supposed to have a library card. This card can be requested at the desk of the central library. To make the request the student must bring an Personal Identification (passport, driver's licence, etc.) and an Adress Identification (recent bank statement, insurance policy, etc.). The library card is free from charge and for personal use only.

3.6 Lecture notes and books

Most lecture notes, which are used for lectures at the faculty, can be bought at the 'repro', as well as some books and office articles are available. Books are also available at student association 'Leeghwater' (www.leeghwater.nl) and VSSD (www.vssd.nl).
Opening hours repro: Monday to Friday 9:00 - 16:00
http://www.io.tudelft.nl/repro/, 015 2783062
Location: 10, BG.

For courses at other faculties, lecture notes can be bought at the concerning faculties:
- Aerospace Engineering: 1st floor, 015 27 81250
- Applied Physics: room no. C 057, 015 27 87992
- Civil Engineering: 015 27 81727
- Management of Technology: ground floor, next to entrance, 015 27 86373
- Electrical Eng, Mathematics, Computer sc. (EWI): room 350, 015 27 87855

3.7 Mailbox and access to the internet

Each student has the possibility to acces and communicate on the Internet. Therefore each student receives a faculty login account and an e-mail account. The email account is accessible everywhere, via a webmail server. At the faculty students can use printers, plotters, scanners, etc.

Printing Printing is paid for by a print account. Each student gets a welcome account of €11.50 to start with. At the reception desk the account can be upgraded, from 8:30 till 16:30. It is possible to check the print account at all time, by pointing with the mouse on the 'dollar sign'-symbol in the taskbar at any computer at the faculty.

The services mentioned above are taken care of by:

I&A Service information and automation (Dienst Informatisering en Automatisering) (I&A): Managing of computers, servers and the network.
Phone: 015 27 82001
E-mail: helpdesk@3me.tudelft.nl

System administrator and postmaster J.M.Kalkman, phone: 015 27 86858, e-mail: j.m.kalkman@ocp.tudelft.nl, room 8A-1-06

DTO Service Technical Support (Dienst Technische Ondersteuning) (DTO): Supporting when problems with accounts occur.
Phone: 015 27 82000
E-mail: info@dto.tudelft.nl

3.8 Catering

The faculty offers a variety of catering facilities.

Canteen The faculty canteen serves a comprehensive lunch. The canteen can be found at location 10, BG.

Coffee corner The coffee corner is specialised in a quick snack. The coffee corner is situated near the main entrance (8F). Chairs, tables and couches are available. Opposite of the coffee corner there are dispensers for coffee, candy bars, sodas, soup, etc. Paying at these dispensers is only possible with the electronic chipcard 'chipknip'.

Faculty room The faculty room is a place for giving symposia, meetings or graduation parties ("afstudeerborrels"). A reservation can be made at the desk of the education support staff.

Lagerhuysch The Lagerhuysch is situated below ground level in section 8B, with access from the square in front of the faculty. The Lagerhuysch offers the possibility for celebrating graduation parties (afstudeerborrels), but also for organising symposia and meetings. The students associations Gezelschap Leeghwater and William Froude regularly organise activities.
On the site http://www.lagerhuysch.tudelft.nl a route description and a reservation form for the Lagerhuysch can be found.

Auditorium Within the TU Delft auditorium a variety of catering facilities is available. Lunch time is from 11.30 till 13.30, diner time from 16.30 till 19.30. See appendic 6.5 for the location.

Service for Students

4 DUT - Services for students

Delft University of Technology (DUT) provides several service centres for students:
- Student Facility Centre
- Sports Centre
- Cultural Centre 'Mekelweg 10'
- Library

For all other services: refer to the DUT website, http://www.tudelft.nl.

SFC

The Student Facilities Centre (SFC) consists of several departments, which provide a diversity of services to students, staff members and faculties.

Some examples of these services are provision of information concerning:
- Studying abroad
- All possible forms of education at DUT
- Study support and advise
- Housing
- Financial support and sponsoring for students and student associations

Student Facilities Centre Front Office
Julianalaan 134
2628 BL Delft
Postbus 5
2600 AA Delft
Phone: 015 27 88012
http://www.sfc.tudelft.nl

Sports Centre

The Sports Centre provides all kinds of sports activities:
- Indoors, in several halls and gyms, in which almost any kind of sport can be done.
- Courses and trainings organized by professional instructors.
- Outdoors there are 12 tennis courts and (natural) grass fields for playing soccer, hockey, cricket, rugby, baseball and softball. Most of these fields are illuminated during evenings.

It is possible to use the facilities on an individual basis.

Sports Centre
Mekelweg 8
2628 CD Delft
Phone: 015 27 82443
Fax: 015 27 87087
http://www.sc.tudelft.nl

Cultural Centre 'Mekelweg 10'

Anyone who likes to express oneself in an artistic manner can do this is at the Cultural Centre. The activities and courses are aimed at cultural education and at stimulating forms of expression such as: (audio-)visual, communicative, musical and dancing. 'Mekelweg 10' also supports cultural activities of student organisations and members of DUT staff.

The facilities are:
- Design studios
- Several studios for midi and Deejay's
- Darkroom for photography
- Video editing room
- Rehearsal room for musicians

Cultural Centre 'Mekelweg 10'
Mekelweg 10
2628 CM Delft
Phone: 015 27 83988
Fax: 015 27 83946
http://www.cc.tudelft.nl

ICT Infrastructure

Infrastructure services, concerning telephony and ICT facilities are provided by DTO (Technical Support Service). Services concerning students, as described at http://www.dto.tudelft.nl are:

- Internet facilities for student accommodation:
  A number of internet acces facilities for student accommation are offered by the TU Delft.

- OLI:
  OLI is a foundation that supports students, by offering internet facilities, e.g. to support websites. This is possible for all kind of student organisations, like student associations, study associations, student's houses, etc.
  http://www.oli.tudelft.nl

Course descriptions

In general courses are given in English:

- **E: means that the course is given in english**
- **ER: means that the course is given in Dutch, on request the course is given in English**

For complete course descriptions see website, campus.3me.tudelft.nl.

ae3302	**Flight dynamics 1**
Lecturer	prof.dr.ir. J.A. Mulder
Course Material	J.A. Mulder, W.H.J.J. van Staveren, J.C. van der Vaart, "Flight Dynamics", Lecture-Notes AE3-302
Description	Flight Dynamics, Flying Qualities, static and dynamic stability, Reference Frames and Transformations.Equations of Motions Longitudinal aerodynamic forces and moments. Objectives: Thorough introduction to airplane flight dynamics, stability and control. Relation between aerodynamic phenomena and both static and dynamic stability and control characteristics. Non-linear and linear equations of motion, symmetrical and asymmetrical characteristic motions. This course may be extended with practical ae 3302p (3 EC)
Education	Lecture 2/2/0/0 **EC** 4.5
Assessment	Written

ae4301	**Automate Flight Control System Design**
Lecturer	dr. ir. S. Bennani
Course Material	M.V. Cook, Principles in flight dynamics, Edward Arnold, London, 1997. This course may be extended with practical ae 4301p (1.5 EC).
Description	Classical control is still predominantly used in aerospace industry for the design and analysis of automatic flight control systems. Various exisiting control systems such as Control Augmentation Systems, Generic Autopilots, Fly-by-wire systems and many other control systems are reviewed in detail. The emphasis of the course lies in demonstrating through application of classical frequency domain and state space techniques how to design systems fulfilling the requirements imposed by the aviation authorities with highlights on understanding the benefits and limitations of such systems.
Education	Lecture 0/4/0/0 **EC** 3
Assessment	Written or computer exercise

ae4305	**Spacecraft dynamics and control**
Lecturer	dr. Q.P. Chu
Course Material	Q.P. Chu, 'Spacecraft Attitude Dynamics and Control', Handout lecture notes, Faculty of Aerospace Engineering, Delft University of Technology.
Description	This lecture gives the fundamentals and advances of spacecraft attitude dynamics and control. The following contents are taught during the course period. Spacecraft attitude dynamics and control, Rotational kinematics, Rigid body dynamics, Attitude sensors and attitude determination techniques, Attitude control actuators, Single- and dual-spin stabilisation, Gravity gradient stabilisation, Three axis active attitude control, Nonlinear control of spacecraft attitude, Model predictive control, Matlab examples and exercises This course may be extended with practical ae 4305p (1.5 EC)
Education	Lecture 0/4/0/0 **EC** 3
Assessment	Take-home assignments

ae4361	Flight Simulation
Lecturer	dr.ir. M.M. van Paassen, ir. O. Stroosma, dr.ir. M. Mulder
Course Material	Handouts, material on blackboard
Description	Historical review, Flight simulation and human perception, Flight simulation hardware, Flight simulation hardware; motion systems and control loading systems, Real-time aspects, Distributed simulation, Introduction to DUECA/DUSIME (the Delft University Environment for Communication and Activation/Delft University Simulation Environment). A practical is included in the course, the participants will create a flight simulation.
Education	Lecture 0/0/0/4 **EC** 3
Assessment	

ce3511	Modelling and Computational Methods in Process Technology
Lecturer	Peter J.T. Verheijen, C.Sorin Bildea, Johan Grievink
Course Material	Process Modelling and Model Analysis, Hangos, K. and I. Cameron, 2001, Academic Press; Modellbildung, Lecture Notes, W.A. Marquardt, 2004. Selection from articles and PhD theses.
Description	Course aims at physical and mathematical insights in fundamental, predictive process models and hands-on experience with the numerical techniques to solve such models. development cycle, 'first principles' model (structure), simulation, estimation, optimization, solutions and properties of solutions, model reduction, non-linear sets and sparse systems, differential (algebraic) equations in existing dynamic process simulators; discretisation and orthogonal collocation, index problems, Optimisation techniques. An introduction will be given to other state-of-the-art process simulation packages.
Education	Lecture 0/0/2/2 **EC** 4
Assessment	Project and oral examination

ct4801	Transportation and spatial modelling
Lecturer	dr. M.C.J. Bliemer , Prof.dr.ir. P.H.L. Bovy
Course Material	Transportation Modeling lecture notes, Spatial Modeling lecture notes, "Transportation Modeling: Exercises in OmniTRANS"
Description	Objectives of modeling in transport and spatial planning. Model types. Theory of travel and locational behavior. System description of planning area. Theory of choice models. Aggregate and disaggregate models. Mode choice, route choice and assignment modelling. Locational choice modelling. Parameter estimation and model calibration. Cases and exercises in model application.
Education	Lecture 10/0/0/0 **EC** 6
Assessment	

ct4821	**Traffic flow theory and simulation**
Lecturer	dr. ir. S.P. Hoogendoorn, prof.dr. H.J. van Zuylen, ir. T. Dijker
Course Material	Reader Verkeersafwikkeling (vk4820a, H. Botma) + aanvulling.
Description	Lecture + practical The practical consists of two parts. The first part consists of two exercises with the microscopic traffic simulation model FOSIM. The exercise pertains to the bottleneck design and the design of buffers. The second part of the practicum will involve ramp-meter design with the macroscopic simulation model METANET. The practicum will be concluded with a joint desgn exercise for an interface between a highway and a controlled urban mini-network.
Education	Lecture 0/0/8/0 **EC** 4.5
Assessment	

ct4822	**Dynamic Traffic Management: Traffic control**
Lecturer	prof.dr. H.J. van Zuylen, ir. Th.H.J. Muller
Course Material	Lecture notes
Description	Analysis of traffic flows on intersections, networks and ramps; Assessment of alternative solutions for bottlenecks; Relationship between policy goals and traffic management; Modelling traffic flows on controlled intersections and roundabouts; The use of simulation programs for controlled and uncontrolled intersections, networks, roundabouts and ramps; Design of intersection control; Evaluation of intersection control, Ramp control; Design of a packaged of DTM measures for the interface between a motorway and an urban network
Education	Lecture 0/8/0/0 **EC** 4.5
Assessment	

ct5804	**ITS Dynamic Management**
Lecturer	dr.ir. H. van Lint
Course Material	Reader.
Description	Individual literature study of relevant papers in the domain of ITS; Overview of the application of DTM and the interaction with traffic and transport processes; Tranvelers; response on DTM measures; The physologival aspects of ITS; Anticipatory optimisation of traffic control; Dynamic traffic assignments and simulation for DTM; Capacity management; Case studies big cities in NL and other countries; Evaluation of DTM; Road pricing and related services; Network control; Decision Support Systems for traffic managers; Neural networks applications for traffic monitoring; Fuzzy control systems
Education	Lecture 4/0/0/0 **EC** 3
Assessment	

et4245wb	**Electromechanical systems**
Lecturer	dr.ir. H. Polinder
Course Material	J.C. Compter, 'Mechatronics, Introduction to Electromechanics', lecture notes
Description	Elektromechanics, magnetic circuits, permanent magnets, DCmotors, brushless DC motors, drives, linear motors, principles and limitations
Education	Lecture 0/0/0/3 **EC** 4.5
Assessment	Project or test

lm3511	**Systems Biology**
Lecturer	Prof.dr.ir. J.J. Heijnen
Course Material	Handouts
Description	System Biology (SB) provides a mathematical framework for biological systems, particularly cells. Cells are regarded as integrated machines which integrate matter, energy and information. The quantitative principles of this integration are the focus of SB. The aim is to provide mathematical models in an experimental context and which capture increasing levels of complexity of cellular function (growth, production, metabolism, genetic control ...).
Education	Lecture 0/0/3/3 **EC** 6
Assessment	Tasks + presentations

sc4010	**Introduction Project SC**
Lecturer	ir.P.C. Teerhuis, dr.ir.A.J.J. van der Weiden, dr.ir. T.J.J. van den Boom
Course Material	Lecture Notes
Description	To achieve good controller designs it is necessary to connect theory with problems of practical interest. In this project the concepts and theory of the basic program concerning Control Systems and Signal Analysis will be reviewed. Implementation issues of e.g. PID controllers via continuous-time techniques on real experimental servo-systems are treated. The laboratory sessions use a digital signal processing controller manufactured by dSPACE. These controllers are programmed via the Simulink block diagram language which is part of the Matlab control system design software.
Education	Project x/0/0/0 **EC** 3
Assessment	

sc4020	**Control Theory**
Lecturer	prof.ir. O.H. Bosgra
Course Material	Friedland,B. Control System Design: An Introduction to State-Space Methods, 1986
Description	Control design basic theory. State space description of linear dynamic systems. Controllability, observability. Pole assignment, state feedback, sensitivity function. Linear observers, Kalman filter. Design and separation principle. LQ regulator and LQG theory. dynamic compensation. Internal model principle. Standard plant formulation, loop shaping for dynamic response. H2 and Hinf design. Examples, Matlab tools. Take-home design exercise as part of examination requirements.
Education	Lecture 4/0/0/0 **EC** 6
Assessment	

sc4031	**Modeling and system analysis**
Lecturer	dr.ir. J.M.A. Scherpen
Course Material	Reader, lecture notes, slide handouts
Description	Brief introduction into modeling of dynamical systems with help of differential and algebraic equations, Euler-Lagrange and Hamiltonian equations. Linear versus nonlinear, global, local, limit cycles, spaces, tc. Stability analysis for nonlinear systems. The center manifold theorem. Passivity of physical systems. Minimality, accessibility and observability for nonlinear systems. Examples mainly from electro-mechanical systems. Balancing, model reduction and realization theory for linear systems.
Education	Lecture 0/3/0/0 **EC** 4
Assessment	Written examination (closed book)

sc4040	**Filtering and identification**
Lecturer	Prof. dr. ir. M. H. G . Verhaegen,
Course Material	Lecture notes: "Filtering and System Identification:An Introduction", by Michel Verhaegen and Vincent Verdult
Description	The objective of this course is to show the use of linear algebra and its geometric interpretation in deriving computationally simple and easy to understand solutions to various system theoretical problems. Review of of some topics from linear algebra, dynamical system theory and statistics, that are relevant for filtering and system identification. Kalman filtering as a weighted least squares problem. Prediction error and output error system identification as nonlinear least squares problems. Discussion of some practical aspects in the system identification cycle.
Education	Lecture 0/4/0/0 **EC** 6
Assessment	Written examination + practical exercise

sc4050	**Integration project**
Lecturer	prof.dr. R. Babuska, ir. A.E.M. Huesman
Course Material	Handouts
Description	The goal of this integration project is to apply the theoretical knowledge gained in the previous courses to real-world problems. Laboratory setups are used, including electro-mechanical systems (such as the inverted pendulum, acrobot) as well asprocesses (distillation column, heat transfer). The essential steps of modeling andcontrol design will be exercised: physical modeling, parameter estimation, systemanalysis, control design, simulation, real-time implementation and validation of a control system. MATLAB and SIMULINK are used as the main software platform.
Education	Project 0/0/0/4 **EC** 5
Assessment	Written report

sc4060	**Model predictive control**
Lecturer	dr.ir. T.J.J. van den Boom, prof.dr.ir. A.C.P.M. Backx
Course Material	Lecture notes 'Model Predictive Control' by Ton van den Boom (TU Delft) and Ton Backx (TU Eindhoven), 2004-2005
Description	A general introduction is given in model predictive control. Prediction of signals, model structures, uncertainty equivalence principle, receding horizon principle, signal constraints. Stability and robustness of controlled systems using Lyapunov functions.
Education	Lecture 0/0/3/0 **EC** 4
Assessment	Homework assignment

sc4070	**Control systems lab**
Lecturer	prof.dr. R. Babuška, Schutter, dr.ir. B. de
Course Material	Åström K.J. and B. Wittenmark Computer Controlled Systems - Theory and Design. 3rd ed. Prentice Hall, 1997. Download material.
Description	In this course, students have the opportunity to design and implement their own controllers for various laboratory systems (helicopter model, inverted pendulum, inverted wedge, rotational pendulum). In this way, they gain more insight in the use of control theory and gain experience with the practical implementation of computer-controlled systems. MATLAB and SIMULINK are used as the basic platform for the design, analysis, simulation and real-time implementation.
Education	Lecture 0/0/4/0 **EC** 4
Assessment	Laboratory assignment

sc4080	Knowledge based control systems
Lecturer	prof.dr. R. Babuska, prof.dr.ir. J. Hellendoorn
Course Material	Lecture notes and material that is to be downloaded
Description	Theory and applications of knowledge-based and intelligent control systems, including fuzzy logic control and artificial neural networks: Introduction to intelligent control; Fuzzy sets and systems; Intelligent data analysis and system identification; Knowledge based fuzzy control (direct and supervisory); Artificial neural networks, learning algorithms; Control based on fuzzy and neural models; Examples of real-world applications.
Education	Lecture 0/0/3/0 **EC** 3
Assessment	Written

sc4090	Optimization in systems and control
Lecturer	dr.ir. B. De Schutter, dr.ir. T.J.J. van den Boom
Course Material	Lecture notes
Description	In this course we study several examples of the use of numerical optimization methods in systems and control. First, the basic characteristics and properties of various optimization methods are discussed. Next, these methods are used in a multi-criterion controller design application. We also focus on the translation of the design constraints into mathematical constraints. Other important topics are the determination of the most appropriate optimization method for a given problem, determination of good initial conditions, and computation of gradients.
Education	Lecture 4/0/0/0 **EC** 3
Assessment	Written + homework assignment

sc4100/wb2414	Mechatronic design
Lecturer	dr.ir. J.B. Klaassens, dr.ir. P.J. Bax, ir. H. Wierda, dr.ir. E. Holweg, Eijk, prof. dr. ir. J. van, Teerhuis, ir. P.C.Handouts and download material
Course Material	Handouts and download material
Description	Mechatronics: An introduction Elementary principles of mechanics. Physical Modeling. Actuators: DC motor, Permanent magnet motor, stepper motor. Piezo actuator. Force control. Sensors for mechatronic applications. Hydraulic amplifier. X-by-wire.
Education	Lecture 2/2/0/0 **EC** 3
Assessment	Written

sc4110	System Identification (formerly tn3111)
Lecturer	dr.ir. X.J.A. Bombois, prof.dr.ir. P.M.J. Van den Hof
Course Material	Lecture Notes System Identification
Description	Experimental modeling of dynamic systems; methodology. Discrete-time signal- and system-analysis. Identification of transfer-functions. Representations of linear models; black-box models. Identification of prediction-error-methods; least squares-method. Approximation modeling; algorithms. Experiment design and data-analysis; closed-loop identification; model validation; Matlab toolbox
Education	Lecture 0/0/4/4 **EC** 5
Assessment	Oral + project

sc4120	Special topics in signals, systems and control
Lecturer	prof.dr. C.W. Scherer, prof.dr.ir. Van den Hof
Course Material	Lecture notes or book to be announced.
Description	Lectures on specifically chosen subjects related to recent developments in the fields of signal analysis, system identification and control theory. The format can vary from full courses taught by guest lecturers to a sequence of student lectures in seminar form revolving around coherentspecial topics.
Education	Lecture 0/0/0/2 **EC** 3
Assessment	Assignment

sc4130	**Modern robotics (formerly et4148)**
Lecturer	dr.ir. J.B. Klaassens, dr.ir. T.J.J. van den Boom
Course Material	John J. Craig, Introduction to Robotics, Mechanics and Control.Second Edition, Addison-Wesley Publishing Company, 1989.
Description	Introduction in Robotics. Description of 3D movements. Direct and inverse kinematics. Dynamics of physical elements. Lagrange equations. Control of robots. Position and force control. Interactive control. Mobile robots.
Education	Lecture 0/0/4/0 **EC** 4
Assessment	Written

sc4150	**Fuzzy logic and engineering applications (formerly et4137)**
Lecturer	prof.dr.ir. J. Hellendoorn, dr. R. Babuska
Course Material	Lecture notes
Description	Fuzzy logic techniques can be applied in various engineering domains, mainly in fields where reasoning under uncertainty plays an important role. This course provides background in fuzzy set theory, fuzzy logic and related soft-computing techniques with applications in control, information and data processing, artificial intelligence and decision making.
Education	Lecture 3/0/0/0 **EC** 3
Assessment	Written

sc4160	Modeling and control of hybrid systems
Lecturer	dr.ir. B. de Schutter
Course Material	Lecture notes
Description	Hybrid systems are characterized by the interaction of time-continuous models (governed by differential or difference equations) on the one hand, and logic rules and discrete-event systems (described by, e.g., automata, finite state machines, etc.) on the other. In this course we give an overview of the field of hybrid systems ranging from modeling, over analysis and simulation, to verification and control. We particularly focus on modeling, analysis, and control of tractable classes of hybrid systems.
Education	Lecture 0/0/4/0 **EC** 3
Assessment	Written

wb2303	Measurement theory and praxis
Lecturer	ir. P.C. Teerhuis, prof.dr.ir. C.A. Grimbergen
Course Material	
Description	Statical and dynamical performance of mechanical measurement systems. Motion and dimensional measurement devices. Force, torque, pressure and temperature measurement devices. Conditioning, transmission and manipulation of measurement data.
Education	Lecture 0/0/2/2 **EC** 3
Assessment	Oral

wb2305	Digital Control
Lecturer	dr. S. Dijkstra
Course Material	K.J. Åström, B.Wittenmark 'Computer-controlled Systems, Prentice Hall ,1990, 2nd edition
Description	Computer control. Sampling of continuous-time signals. The sampling theorem. Aliasing. Discr.-time systems. State-space systems in discrete-time. The z-transform. Sampling-rate. Analysis of discrete-time systems. Stability. Controllability, reachability and observability. Disturbance models. Reduction of effects of disturbances. Stochastic models.Design. Approximations of continuous design. Digital PID-controller. Stata-space design methods. Observers. Pole-placement.Optimal design methods. Linear Quadratic control. Prediction. Minimum-variance. LQG-control.Implementational aspects of digital controllers.
Education	Lecture 0/4/0/0 **EC** 3
Assessment	Written

wb2400	**Proces Control**
Lecturer	dr. S. Dijkstra
Course Material	– Copies of the powerpoint slides are available. – The examples for the simulations with explanation, are available on Blackboard
Description	Dynamic control, Real process characteristics, Common control loops, Linear controllers, nonlinear control elements,multiple-loop systems, cascade control, feedforward control, interaction and decoupling, applications.
Education	Lecture 0/0/2/2 **EC** 3
Assessment	Computer test

wb2402	**Hydraulic Servosystems**
Lecturer	ir. P.C. Teerhuis
Course Material	T.J.Viersma. "Analysis synthesis and design of hydraulic servo systems and pipeline" Blackburn, Reethof and Shearer, Fluid power control, Wiley and Sons
Description	- Dynamic behaviour of hydraulic servo systems - Design of (low function) servo systems - Hydraustatic bearings, hydraulic line dynamics
Education	Lecture 2/2/0/0 **EC** 3
Assessment	

wb2413-04	**Instrumentation in the process industry**
Lecturer	dr.ir. A.J.J. van der Weiden
Course Material	
Description	The course is divided in several blocks: 1) An industrial example to show procedures to start a design cycle and disciplines which might be involved. Planning will be a subject to be focussed on. 2) Lectures, mainly about Process Control and Instrumentation. 3) Further details for instrument engineering such as the level of automatisation and the systems which might be used. 4) Process control and information management systems
Education	Lecture 0/0/0/4 **EC** 2
Assessment	

wb2415	**Robust Control**
Lecturer	prof.dr. C.W. Scherer
Course Material	Lecture notes
Description	Recap on background in linear systems theory. Stabilizing controllers and the concept of the generalized plant. Uncertainty descriptions. The general framework of robust control. The structured singular value: Definition, properties, computation. Robust stability analysis, nominal and robust performance analysis. The algebraic Riccati equation, the H_∞ control problem and its solution in terms of Riccati equations. Design of robust controllers.
Education	Lecture 0/0/4/0 **EC** 6
Assessment	Take-home assignments and oral exam

wb2416	**Linear Matrix Inequalities in Control**
Lecturer	prof.dr. C.W. Scherer
Course Material	Lecture notes
Description	Introduction optimization theory (convexity, interior point methods). Robust stability tests for time-varying parametric and non-linear uncertainties. Integral quadratic constraints as a general paradigm for robustness analysis. Performance analysis for various criteria. Extensions to robust performance analysis. From analysis in terms of linear matrix inequalities to controller synthesis: a general procedure. Design of robust controllers: state-feedback and output-feedback control. Design of multi-objective controllers. Linear-parametrically-varying systems and the design of linear parametrically-varying controllers.
Education	Lecture 0/0/0/4 **EC** 6
Assessment	Take-home assignments and oral exams

wb2421	**Multivariable Control Systems**
Lecturer	dr. ir. A.J.J. van der Weiden
Course Material	Multivariable Feedback Control Analysis and Design. S.Skogestad, I.Postlethwaite. John Wiley & Sons, ISBN 0-471-94330-4 , and Lecture notes
Description	Single loop feedback. Poles, zeros and stability of multivariable feedback systems. Decoupling by state-feedback for linear as well as nonlinear systems. Robust servomechanism problem for multivariable systems: asymptotic tracking of reference signals with disturbances. Nyquist-like multivariable design techniques: the characteristic-locus and Nyquist-array methods. Performance and robustness of multivariable systems. Singular values for assessing performance; classical control theory. Model uncertainties. H-infinity norm. Structured singular value. Weighting functions for H-infinity controller.
Education	Lecture 0/4/0/0 **EC** 6
Assessment	Oral exam and exercises

wb2426	Chemistry and Chemical Plant
Lecturer	ir. A.E.M. Huesman
Course Material	
Description	Chemistry: elements, the periodic table and atoms, chemical bonding, reaction and melcules, the mole concept, chemical thermodynamics, chemical equilibrium and kinetics, industrial chemistry. Chemical plants: scale-up, unit operations (includes reactors and distillation columns), flowsheets, other aspects of plants (safety and economics), designing plants.
Education	Lecture 0/0/2/2 **EC** 3
Assessment	

wb2427	Predictive modelling
Lecturer	prof.dr.ir. J. van Eijk
Course Material	Handouts
Description	Mechatronisch ontwerpen, gedrag voorspellend ontwerpen, systeem ontwerp, modelleren, simuleren, dynamisch gedrag, modaal analyse, servo systemen, machine dynamica
Education	Lecture 0/0/4/0 **EC** 3
Assessment	Written

wi4039	Systems theory
Lecturer	prof.dr. A.A. Stoorvogel, prof.dr. A.C.M. Ran (VU)
Course Material	Lecture notes
Description	Objectives: understand the fundamental structure of linear systems with inputs and outputs. Contents: recalling standard notions of linear systems described by state space models such as controllability and observability. Properties such as zero dynamics, system invertibility and invariant zeros of a linear system are introduced and connected to certain geometric subspaces. Used this in disturbance decoupling and disturbance rejection and the limitations imposed by the structure of the system. It is established how this can also be used in observer design and to understand the related limitations in estimation.
Education	Lecture 0/0/3/0 **EC** 6
Assessment	

wi4040	Optimal Control
Lecturer	dr.ir. W.L. de Koning
Course Material	F.L. Lewis, Optimal control, Wiley, 1986
Description	Objectives : 1. Optimal control with variational calculus, 2. Extension to bounded controls (Pontryagin), 3. Continuous time versus discrete time, 4. Practice. Contents: Control a dynamical system such that it behaves like you want it to. One way is to translate your wishes into a criterion, such that minimizing the criterion gives the wanted control. Such a control is called optimal. There are different approaches, the Pontryagin and Bellman approach, and special situations, namely bounded controls and bounded states. Practical controls should be implemented on a digital computer.
Education	Lecture 0/0/4/0 **EC** 6
Assessment	Oral exam and report

Appendices

6.1 Course and Examination Regulations

Section 1 GENERAL

Article 1 SCOPE AND APPLICABILITY OF THESE REGULATIONS

1. These regulations are applicable to teaching and examinations of the Master's degree programme Systems and Control at Delft University of Technology, hereafter referred to as *the programme*.
2. These programmes are conducted under the responsibility of the Faculty of Mechanical Engineering and Marine Technology at Delft University of Technology, hereafter referred to as *the Faculty*.
3. For this programme, implementation procedures are in effect that supplement, and are integral to, these Course and Examination Regulations.
4. The Course and Examination Regulations and the implementation procedures are laid down by the Dean.

Article 2 DEFINITIONS

Any terms in these regulations also occurring in the Higher Education and Academic Research Act (WHW) will have the same meaning as that intended by that Act.
In these regulations, the following terms shall be understood as follows:

a. the Act: the Higher Education and Academic Research Act (abbreviated in Dutch to WHW), including its subsequent amendments;
b. programme: the Master's degree programme referred to in Article 7.3a, subsection 1 under b of the Act;
c. student: anyone enrolled at Delft University of Technology (as a student or "extraneus") for purposes of education and/or for taking the examinations and interim examinations that are part of the programme;
d. practical training: practical exercise as referred to in Article 7.13, subsection 2 under d of the Act, in one of the following forms:
   - writing a thesis;
   - writing a paper/completing an assignment, project or technological design;
   - completing a design or research assignment;
   - conducting literature study;
   - completing a work placement;
   - taking part in fieldwork or an excursion;
   - conducting tests and experiments;
   - or participating in another educational activity focused on the attainment of a particular skill.
e. interim examination: a test of a student's knowledge, insight and skills with regard to a particular unit of study, and the assessment of this examination by at least one examiner appointed for that task by the examinations board.

h.	examination:	test used by the examinations board to establish whether all interim examinations and tests that are part of the study programme have been successfully completed as specified in Article 7.10 of the Act.
i.	examinations board:	the examinations board as appointed according to Article 7.12 of the act.
j.	implementation procedures:	the implementation procedures integral to the Course and Examination Regulations and applicable to a specific Master's programme.
k.	working day:	each day from Monday to Friday, with the exclusion of official national holidays.
l.	course calendar:	the publication containing all the specific information appropriate to a specific Master's course guide named in Article 1.
m.	examiner:	those appointed by the examinations board for the purpose of taking interim examinations in accordance with Article 7.12 of the Act;
n.	EC:	European Credits as specified in the European Credit Transfer System
o.	The University:	Delft University of Technology

Article 3 OBJECTIVE OF THE MASTER PROGRAMME SYSTEMS AND CONTROL

The goal of the master programme Systems and Control is to educate graduates in System and Control Engineering to an academic engineering level. The level corresponds to the technological borders of a specific discipline. The graduates are capable:

- To identify, define and analyse problems, for the solution to which systems-and-control principles and techniques can contribute
- To develop and to produce a sound solution to the problem
- To present these solutions effectively

The programme is directed towards the analysis and design of reliable and high-performance measurement and control strategies for a wide variety of technological dynamical processes. It is centred around fundamental generic aspects of systems and control engineering, while it stresses the multidisciplinary character of the field concerning its applications in mechanical engineering, electrical engineering, applied physics, aerospace engineering and chemical engineering, such as

- High-accuracy positioning and motion control systems, mechatronics, microsystems, production systems, robotics and smart structures
- (Petro)chemical/physical and biotechnological production processes
- Transportation systems (automotive systems, logistic systems, aerospace)
- Physical imaging systems (acoustic and optical imaging)
- Energy conversion and distribution
- Biomedical systems

The programme brings together issues of physical modelling, experiment design, signal analysis and estimation, model-based control design and optimisation, hardware and software aspects, in the scope of studying systems of high complexity and of different nature, such as linear and nonlinear dynamics, hybrid and embedded systems, and ranging from small-scale microsystems to large-scale industrial plants.

Article 4 ADMISSION TO THE MASTER'S PROGRAMME

1. Admission to this programme will be granted to students in possession of a degree issued for the Bachelor's programme in either Mechanical Engineering, Electrical Engineering, Technical Mathematics, Applied Physics, Chemical Engineering or Aerospace Engineering, issued by the Delft University of Technology, Technische Universiteit Eindhoven, University of Twente or one of the universities of the IDEA-league.
2. Students who are not graduates of one of the Bachelor's programmes specified in paragraph 1 but who are in possession of a confirmation of admission provided by the Faculty will be eligible for admission.
3. To obtain confirmation of admission, a student must satisfy the criteria specified in paragraph 1.4 of the study guide.
4. If so requested by a student who is not in possession of a Bachelor's degree as specified in paragraph 1, the examinations board may depart from paragraph 1 by allowing that student to attend parts of the Master's programme.

Article 5 FINAL QUALIFICATIONS OF THE MASTER PROGRAMME SYSTEMS AND CONTROL

The graduated Master of Systems and Control Engineering meets, to a sufficient level, the following qualifications:

1. Broad and profound knowledge of engineering sciences (electrical engineering, mechanical engineering, applied physics, mathematics) and the capability to apply this knowledge at an advanced level in the systems-and-control-engineering discipline.
2. Broad and profound scientific and technical knowledge of the systems-and-control-engineering discipline and the skills to use this knowledge effectively. The discipline is mastered at different levels of abstraction, including a reflective understanding of its structure and relations to other fields, and reaching in part the forefront of scientific or industrial research and development. The knowledge is the basis for innovative contributions to the discipline in the form of new designs or development of new knowledge.
3. Thorough knowledge of paradigms, methods and tools as well as the skills to actively apply this knowledge for analysing, modelling, simulating, designing and performing research with respect to innovative technological dynamical systems, with an appreciation of different application areas.
4. Capability to independently solve technological problems in a systematic way involving problem analysis, formulating sub-problems and providing innovative technical solutions, also in new and unfamiliar situations. This includes a professional attitude towards identifying and acquiring lacking expertise, monitoring and critically evaluating existing knowledge, planning and executing research, adapting to changing circumstances, and integrating new knowledge with an appreciation of its ambiguity, incompleteness and limitations.
5. Capability to work both independently and in multidisciplinary teams, interacting effectively with specialists and taking initiatives where necessary.
6. Capability to effectively communicate (including presenting and reporting) about one's work such as solutions to problems, conclusions, knowledge and considerations, to both professionals and non-specialised public in the English language.
7. Capability to evaluate and assess the technological, ethical and societal impact of one's work, and to take responsibility with regard to sustainability, economy and social welfare.
8. Attitude to independently maintain professional competence through life-long learning.

Article 6 FULL-TIME AND PART-TIME COURSE FORMAT

The Master's programme will be provided on a full-time basis.

Article 7 LANGUAGE

1. English shall be the language used for all teaching and examinations.
2. In certain cases, the Dean may depart from paragraph 1 by giving permission for teaching to take place in Dutch, if this is necessitated either by the specific nature of the organisation, the quality of the course, or the students' origins and backgrounds.
3. If a student asks to be allowed to take one component, or several components, of an examination in a language other than English, the terms of the regulations and the guidelines of the board of examiners will be applicable accordingly.

Section 2 COMPOSITION OF THE MASTER'S PROGRAMME AND THE FINAL EXAMINATION

Article 8

1. The composition of the educational programme is laid down in the implementation procedures. This educational programme starts once a year, in September.
2. The examination for a Master's Degree is an integral part of the programme. The study load for this examination totals 120 EC.

Section 3 INTERIM EXAMINATIONS

Article 9 THE NUMBER, PERIOD AND FREQUENCY OF INTERIM EXAMINATIONS

1.a. Each course shall provide at least two opportunities per year to sit interim examinations:
- the first shall follow immediately after the teaching period in which the relevant component was taught and completed;
- the second shall be given at the end of the second semester, or otherwise in the August resit period.

1.b. The interim examinations referred to under a. shall be held as indicated for the unit of study concerned in the timetable for the current academic year. At the beginning of each academic year, a timetable specifying the dates and times of written interim examinations shall be drawn up and published.

2. In the event that a course component is not taught within the Faculty itself, and therefore there is no indication of the number of times it is possible to sit an interim examination as referred to in paragraph 1, the course and examination regulations of the relevant Faculty or degree programme will be applicable, provided no decision to the contrary has been taken by the board of examiners.

3. Notwithstanding the provisions of the first clause under 1a, at least one opportunity shall be given per year to take an interim examination in a course component that has not been taught in that year.
4. In certain cases the examinations board may allow departures from the specified number of times that an interim examination can be sat.

Article 10 THE ORDER OF INTERIM EXAMINATIONS

The implementation procedures shall specify the order in which the interim examinations will be taken, or in which students be to participate in practical training.

Article 11 THE PERIOD OF VALIDITY OF INTERIM EXAMINATIONS

1. Students who have interrupted their studies, or who have delayed their studies for other reasons, shall resit any component they passed ten years or more ago if its contents have since been modified.
2. The examinations board may, in a student's favour, depart from the provisions of paragraph 1.

Article 12 THE FORM OF THE INTERIM EXAMINATIONS, AND THE METHOD OF TESTING

1. Per year, the form in which each interim examination is to be taken shall be specified in the study guide for the actual course year under the unit of study concerned.
2. If no specification is made of the way in which an interim examination can be taken, because that examination applies to a unit of study that is not taught within the Faculty, and because it involves a unit of study that is not specific to students taking part in a programme administered by the Faculty of Mechanical Engineering and Marine Technology, the relevant conditions in the Course and Examination Regulations for that unit of study shall be applicable. Each year, the examinations board under which the interim examination falls shall determine the way in which the interim examination is to be taken.
3. The appointed examiner may depart from the provisions of paragraphs 1 and 2 in a student's favour.
4. Each student with a physical or sensory disability shall be given the opportunity to take all interim examinations and practical training in a way that, to the greatest possible extent, is adapted to the disability in question. Under this facility, the form or length of the interim examinations shall be adapted to the individual situation, or practical aids shall be made available.
5. The facilities specified in the previous paragraph should be requested from the examinations board by the student concerned. This request should be accompanied by a medical certificate issued no more than one year previously by a doctor, psychologist or student counsellor. All requests involving dyslexia should be backed by a recognised dyslexia testing body.

Article 13 ORAL INTERIM EXAMINATIONS

1. Unless otherwise determined by the examinations board, no oral interim examination shall involve more than a single student at the same time.
2. All oral interim examinations be public, unless, in exceptional circumstances, the examinations board or the individual examiner decide otherwise, or if the student has submitted an objection.

Article 14 THE ESTABLISHMENT AND NOTIFICATION OF RESULTS

1. Immediately after taking an oral interim examination, the examiner shall announce the result, and issue the student with the relevant written notification.
2. As soon as possible after a written interim examination, and always within a maximum of 15 working days, the examiner shall declare the results. The examiner shall provide the Faculty's student administration office with the necessary details. Paying all due attention to the privacy of individual students, the student administration office shall take responsibility for the registration, publication and reporting of the results within 20 working days of the interim examination.
3. If an interim examination is taken neither in writing nor orally, but in another form, the board of examiners shall decide in advance on the way in which students will be notified of the results, and of the period within which this will occur.
4. When students be provided with written notification of the results of an interim examination, it shall at all times be made clear that they have the right to inspect the relevant examination documents (as defined in Article 15), and that they have the right to appeal to the examination appeals board.

Article 15 CANDIDATES' RIGHT TO INSPECT THEIR EXAMINATION DOCUMENTS

1. For at least one month after the results of a written examination have been announced, it shall be possible for students to inspect their examination and its assessment. At the student's request, he/she will be provided with a copy of the relevant work at cost price.
2. During the period specified in paragraph 1, it is possible for all interested parties to inspect the questions and assignments of the relevant interim examination, and also the norms whereby assessment took place. Upon request a copy of this information shall be provided at cost price.
3. The examinations board may specify that inspection of examination documents will take place at a predetermined place at no fewer than two predetermined times. The place and dates shall be stated on the list of results. If a student can demonstrate that, due to forces beyond his or her control, it was impossible to be present at the predetermined place and time, a new opportunity shall be provided; if possible, this shall fall within the period specified in paragraph 1.

Article 16 OPTIONS FOR DISCUSSING THE RESULTS OF AN INTERIM EXAMINATION

1. As soon as possible after the results of an interim examination have been announced, student or examiner may take an initiative towards discussing the examination, and to explaining its assessment.
2. For a period of one month, starting on the day following the announcement of the results, a student who has taken a written interim examination may apply to the relevant examiner to discuss the work in question. This discussion shall follow at a place and time specified by the examiner, and always within a reasonable period.
3. If, for whatever reason, the examinations board organises a collective discussion after an interim examination, there be only two cases in which a student may submit a request of the type specified in the previous paragraph: either a. by being present at the collective discussion and by simultaneously providing the motives for the request; or b. when, due to circumstances beyond his or her control, it was impossible to attend the collective discussion.
4. The conditions of the previous paragraph shall also apply if the examinations board or the examiner provides the student with an opportunity to compare his or her answers with standard answers.
5. The examinations board may allow deviations from the stipulations of paragraphs 3 and 4.

Section 4 EXEMPTION FROM INTERIM EXAMINATIONS

Article 17 EXEMPTION FROM INTERIM EXAMINATIONS OR PRACTICAL EXERCISE

1. The examinations board can grant students exemption from one or more interim examinations or practical exercises, if they have satisfied the examiners either with regard to earlier interim examinations, or with regard to Higher Education examinations, or with regard to knowledge and skills acquired outside higher education. However, this is possible only if they satisfy at least one of the following conditions:
   a. the interim examination involved a unit of study that, in terms of content and study load, was equivalent to a comparable university course in the Netherlands or beyond, or at an institute of professional education (i.e. HBO institute / hogeschool) in the Netherlands.
   b. the student can provide proof of knowledge or experience acquired either during a course provided somewhere other than at a Dutch institute of professional education, or otherwise during activities conducted in another context.
2. If the relevant examiner has made a fully motivated proposal to this effect, the examinations board may grant exemption from an interim examination.

Section 5 THE MASTER'S EXAMINATIONS

Article 18 PERIODS AND FREQUENCY OF EXAMINATIONS

1. An opportunity to take the Master's examination shall be provided no less than twice a year. In a meeting held before the start of the academic year, the examinations board shall establish the dates on which the examinations be to be held. These shall be published in the study guide for the programme and year in question.
2. All students can apply to take the examinations as soon as they have fulfilled the conditions of their course, and have provided the student administration office with proof of the course components they have passed.

Article 19 REPORTING ON STUDENTS' PROGRESS

1. At least once a year, each student shall be sent a written report on the progress he or she has made over the preceding period.
2. The report referred to in paragraph 1 shall be composed according to the guidelines established by the Executive Board.
3. The Dean shall be responsible for supervising the progress of all students enrolled on the course. Such supervision shall include an assessment of the options for study that be available to students, both inside the programme and beyond it.

Section 6 PROVISIONS FOR IMPLEMENTATION

Article 20 MODIFICATION OF THE REGULATIONS

1. These regulations may be modified in a special decision by the Dean.
2. No decision shall be made in respect of the current academic year, unless, by all reasonable definitions, it is unlikely to damage the interests of students.
3. No change in the regulations may negatively affect a previous decision made by the board of examiners in respect of a student.

Article 21 TRANSITIONAL RULING

1. In the event that the composition of a teaching programme is modified, or that one of the Articles of the Course and Examination Regulations is changed, the Dean shall decide on a transitional ruling, which shall then be published in the implementation procedures.
2. In all cases, this transitional ruling shall incorporate the following:
   a. a ruling on the exemptions that be available on the basis of interim examinations that a student has already passed,
   b. the number of times that it is still possible to sit for interim examinations under the conditions of the old programme,
   c. the period for which the transitional ruling will be valid.

Article 22 PUBLICATION OF THE TRANSITIONAL RULING

1. The Dean shall take responsibility for publicising the following in an appropriate fashion: the transitional ruling defined in Article 21, and the implementation procedures and the changes to it.
2. The Course and Examination Regulations and the implementation procedures for each course shall be incorporated in the study guide.

Article 23 DATE OF COMMENCEMENT

These regulations shall come into force on 1 September 2005.

6.2 Implementation Procedures

for the teaching and examination regulations appropriate to the Master's programme Systems and Control.

Article 1 COURSE CALENDAR

The course calendar for the programme can be found in the Study Guide for the Master's degree programme Systems and Control.

Article 2 COMPOSITION OF THE PROGRAMME

The composition of the Master's degree programme Systems and Control, including number of credit points, assessment, entrance requirements per unit of study is described in the Study Guide.

Article 3 COMPOSING FLEXIBLE STUDY PROGRAMMES

1. Students may themselves compose an individual study programme that will lead to an examination. This programme must consist, either in full or for the greater part, of units of study which be taught on the course they be attending, and may be supplemented with units taught on other courses or at other universities.

2. Each student desiring to compose a programme of the sort referred to in paragraph 1 shall submit his or her own proposal, motivating it in full, for the approval of the relevant examinations board, i.e. at the beginning of the Master's programme.

Article 4 PROCEDURE FOR APPROVING FLEXIBLE STUDY PROGRAMMME

1. No less than two months before they intend to start on a flexible study programme, all students must submit their proposals for their choices of one or more units of study (as referred to in Article 3) for approval by the examinations board. Each proposal must be accompanied by a clearly argued motivation.

2. Any decision not to approve the proposal shall be motivated by the examinations board after the student in question has been given the opportunity of a hearing.

3. The examinations board shall decide within twenty working days of receiving the application, or, if the application is submitted during an academic holiday, no more than ten working days after this holiday has ended.

4. The examinations board can adjourn its decision for no more than ten working days. The student shall be given written notification of such adjournment within the twenty-working-day period referred to in the first sentence of paragraph 3. The student shall receive written notification of the decision without delay.

Article 5 THE ORDER OF INTERIM EXAMINATIONS AND ASSIGNMENTS

The order in which the interim examinations will be taken, assignments shall be fulfilled or in which students be to participate in practical training, is laid down by means of entrance requirements, specified in the description of the contents of the programme in the Study Guide.

Article 6 MASTER'S THESIS

1. The programme is concluded by fulfilling a final assignment and presenting a Master's thesis.
2. The Master's thesis is assessed by an examining committee, assigned by the board of examiners.
3. The student applying for the Master's examination has to defend his thesis before the examining committee mentioned sub 2.

Article 7 ANNOTATIONS

As an addition to the variant programme there is an annotation. After completing this annotation, the student acquires a supplement to the MSc-degree, which declares a more than average knowledge about that subject. This annotation is: Technology in Sustainable Development .

Laid down by the Dean of the Faculty Mechanical, Maritime and Materials Engineering, after the approval of the Faculty's Student Council, and after considering the recommendations provided by the education committee. July 2005.

6.3 Regulations and guidelines for the board of examiners

Article 1 SCOPE OF THE REGULATIONS

These regulations and guidelines are applicable to the teaching of, and examinations for, the Master's degree programme in Systems and Control, hereafter referred to as *the programme*.

Article 2 DEFINITIONS

1 When used in these regulations and guidelines, the term Course and Examination Regulations (CER), refers to the current course and examination regulations as intended under Article 7.12 of the Higher Education and Academic Research Act (abbreviated in Dutch as WHW):
2 All other terms occurring in these Regulations will have the same meaning as that intended in the CER and the WHW.

Article 3 DAY-TO-DAY ADMINISTRATION

The examinations board consists of the lecturers who are engaged in the educational programme and mentioned as such in the curricula, described in section 1.5 of the study guide. The examinations board shall appoint a chair and a secretary from its members. The chair shall be responsible for the day-to-day management of the committee.

Article 4 MASTER'S EXAMINING COMMITTEE

1. The board of examiners appoints a Master's examining committee for the assessment of each Master's thesis.
2. A master's examining committee consists of no less than three members.
3. The professor in charge is chairman of the committee.
4. No less than one member belongs to the scientific staff of the section responsible for the specialisation concerned; no less than one member belongs to the scientific staff of a different section of Delft University of Technology, or any other university.
5. The committee can be completed by experts from outside the University.

Article 5 ENTRY FOR INTERIM EXAMINATIONS

1 Students shall apply for interim examinations at the Faculty's Department of Educational and Student Affairs by entering data in the examination application system, or, if the system is not in use, by submitting a form made available by the Department of Educational and Student Affairs. Whatever the means of application, all submissions must be received no less than ten working days before the interim examination.
2 In exceptional cases, the examinations board can depart from the application period defined in paragraphs 1 and 4 of this Article, provided that this departure is in the favour of the student concerned.

3 Admission to the interim examination will be granted solely to those students who are registered on the list of applicants produced by the examination application system (or by any alternative system currently in force).

4 If, in their opinion, students have not been able to apply for an interim examination due to events beyond their control, they shall apply to the examinations board no less than two full working days before the day for which the examination is planned. By submitting a declaration of demonstrable *force majeure* written or issued by, or on behalf of, the examinations board, the student may be allowed to sit the relevant examination.

Article 6 ORDER DURING AN INTERIM EXAMINATION

1 With regard to written interim examinations, the examinations board and/or the appointed examiner shall be responsible for appointing invigilators who, on behalf of and under the authority of the board of examiners will ensure that the examination runs smoothly.

2 If asked by, or on behalf of, the examinations board, all candidates shall identify themselves by showing their campus card.

3 Candidates shall observe all instructions that have been published before the start of the examination by the examinations board, or by the examiner or invigilator. They shall also follow instructions given during the examination and immediately after it has finished.

4 If a candidate fails to fulfil the conditions of the paragraphs 2 and 3 of this Article, the board of examiners or the appointed examiner can exclude him or her from further participation in the interim examination. The consequence of such exclusion is that no result is established for the examination in question. Before taking such a decision, the examinations board shall offer the student concerned an opportunity to state his or her case.

5 The time allotted for each interim examination shall, by all reasonable standards, be long enough to allow candidates sufficient time to answer its questions.

6 When the interim examination has finished, candidates may keep the assignment papers. The exception to this rule concerns examinations in which questions and answers must be handed in together.

7 Candidates may not enter the examination room until the invigilator gives permission.

8 No candidates are admitted into the examination room no later than half an hour after the official start of the examination.

9 Candidates are not allowed to leave the examination room within the first half hour following the official start of the examination. After this time, permission to leave the room temporarily will be given only in urgent cases. No more than any one candidate may be absent at the same time.

10 Under no circumstances my items such as briefcases, bags and mobile telephones be used or handled in the examination room.

11 Although candidates are responsible for bringing their own calculators and their own writing and drawing materials, the faculty will provide answer sheets and scrap paper.

12 In the event that a certain examination requires students to use calculators, these calculators may at no time be able to exceed the maximum capabilities specified by the examiner for that subject. In general, programmable calculating equipment is not allowed. (Generally examination assignments should be formulated such that they can be carried out with a simple calculator; at no times should candidates with more complex calculators have an advantage.)

13 Candidates may not write their answers in pencil, unless the lecturer has given prior permission for this.

14 During the interim examination, candidates may not consult books, readers, etc., unless the lecturer has given prior permission for this.

[1] Course and Examination Regulations

15 If an invigilator catches a candidate or candidates cheating, the procedure described in Article 6, paragraph 2 of these regulations will be applicable.

16 Before permanently leaving the examination room (i.e. no less than 30 minutes after the start of the interim examination), candidates must, at minimum, submit the front page of the answer sheet. This must bear their name and student number.

17 Before the interim examination begins, the invigilator shall instruct the candidates on the procedure they must follow if they leave the examination room without completing all the examination assignments.

18 Students who believe they may qualify for examination in a different form, should, as specified in Article 12 paragraphs 4 and 5 of the CER[1], submit a fully motivated request for this to the chair of the examinations board.

Article 7 CHEATING

1 Cheating is defined as any act committed by a student for the purpose of making it partly or wholly impossible to make a correct assessment of his or her knowledge, insight and skills.

2 If a student is found to be cheating as defined in paragraph 1 of this Article, the examinations board can decide to exclude him from the interim examination in question.

3 The decision to exclude a student as defined in paragraph 2 of this Article shall be taken on the basis of the invigilator's report of the cheating.

4 In urgent cases, the invigilator is entitled to act on behalf of the examinations board by immediately excluding the student or students concerned. The examinations board shall ensure that, immediately after the interim examination, the report defined in paragraph 3 of this Article is made in writing; and that a copy is issued to the student or students concerned.

5 Within 20 days of his or her exclusion, such a student may appeal to the examinations board to reverse their decision. To this appeal, the student will attach a copy of the report defined in paragraph 4 of this Article; this may also be accompanied by the student's own written testimony.

6 Before deciding on an appeal of the sort defined in paragraph 5 of this Article, the examinations board shall give both student and examiner the opportunity of a hearing.

7 The examinations board will decide on any reversal of the original decision within 30 working days of receiving the student's appeal.

8 The consequence of exclusion is that no examination result will be recorded for the interim examination intended under paragraph 2 of this Article.

9 In the event of cheating, the examinations board can decide, conditionally or unconditionally, to exclude the student from all further interim examinations for a maximum period of one year.

Article 8 CRITERIA

When taking the decisions that are integral to their duties, the examinations board and, where appropriate, the examiner, shall be guided by the criteria stated below. When these criteria conflict, the board shall carefully weigh the interests of allowing one criterion to prevail over another. At all times, these standards must ensure that the following conditions are met:

a that the criteria regarding quality and selection inherent to an interim examination are maintained;

[2] For the period within which students shall be notified of the results of interim examinations, see Article 14 of the Course and Examination Regulations (CER) for the Master's degree programmes.

b that the need for efficiency is met, particularly by limiting to a minimum any time loss that would hinder those students whose preparations for examinations and interim examinations are running to schedule;
c that students who wish to assume too great a study load should be protected from themselves;
d that clemency should be shown in all cases in which students' progress is slowed by circumstances beyond their control.

Article 9 QUESTIONS AND ASSIGNMENTS

1 The scope of an interim examination, and the sources upon which it is based, shall be announced no less than a month before that examination takes place. No questions or assignments in the examination may go beyond the scope of these sources. At the beginning of the course it should be clear what study material (books, lecture notes) will be used during the course.
2 To the greatest possible extent, the questions and assignments of each interim examination shall be evenly distributed over the material being examined.
3 Both in content and form, each interim examination shall represent the learning objectives stated.
4 All questions and assignments shall be clear and explicit. It should also be clear how many credits a question or assignment contributes to the total score of the examination.
5 Well in advance of each interim examination, the examinations board or the examiner shall announce the form of examination and method of testing as meant under Article 12 of the CER.
6 Well in advance of each written interim examination, the examinations board or the examiner shall provide an opportunity whereby students intending to participate in it can examine a similar test on the same subject, together with sample answers and the norms that would be applied during its assessment.

Article 10 ASSESSMENT

1 The assessment of an interim examination is expressed in whole numbers on a scale from 1 to 10, with 6 signifying a pass. If desired, practical training can also be assessed as a "pass" or a "fail". All exemptions for a subject are treated as a 6, i.e. a pass.
2 Students pass their Master's examinations by satisfying the examiners in each component of the Master's programme. Students awarded a 5 in a single subject excepting the thesis project will also qualify for the award of their Master's degree.
3 Per subject, the highest mark awarded for an interim exam will be recorded on the examination certificate.

Article 11 THE ESTABLISHMENT OF EXAMINATION RESULTS[2]

1 The votes of the examinations board shall be established by a simple majority of votes.
2 If the votes are equally divided, the chair of the examinations board shall have the casting vote, unless the vote takes place in writing.
3 If, in a written vote, the votes are equally divided, there shall be a second ballot. If this, too, leads to an equal division of votes, the proposal being balloted shall be rejected.

Article 12 CUM LAUDE

1 At the discretion of the examinations board, a candidate for the Master's degree can receive the designation "cum laude" if he or she meets the following conditions:
   a the mark awarded to the components specified in the Master's examination implementation procedures shall average no less than 8, excluding the Master's Thesis in a list that contains no marks below 6;
   b the candidate concerned shall have completed the Master's degree programme in no more than three years;
   c the mark awarded for the thesis project shall be no less than 9;
   d the examiner of the graduation assignment shall have submitted a proposal for the award of "cum laude".
2 When establishing the elapsed study time referred to in paragraph 1 subsection b of this Article, all due account should be taken of any delays caused by circumstances qualifying the candidate for support under the "Regeling Financiële Ondersteuning Studenten" (RFOS)
3 At all times, the examinations board has the authority to decide on awarding the designation "cum laude" in cases that fall outside the provisions defined above.

Article 13 MASTER'S DEGREE CERTIFICATES AND STATEMENTS

1 To establish that a candidate has satisfied the examiners in the Master's examinations, the board of examiners shall issue a degree certificate. This shall be signed by the chair and the secretary to the examinations board.
2 a The degree certificate as intended under paragraph 1 shall list the specific components of the examination, and, where appropriate, the competencies associated with them.
   b The degree certificate shall be accompanied by marks lists in both Dutch and English.
3 If a candidate's performance during the examinations testifies to exceptional abilities, the board of examiners can, under the conditions stated in Article 11 of these Regulations, decide to grant the designation "cum laude" on the degree certificate.
4 Any student who has successfully completed more than one interim examination and to whom, upon his or her leaving the university, a degree certificate as intended in paragraph 1 of this Article cannot be awarded, shall, upon his or her request, receive a statement from the examinations board in question.

Article 14 PROCEDURE FOR APPROVALS

1 Any student wishing to submit a request as intended under Article 7.3 paragraph 4 of the WHW (i.e. with regard to a flexible study programme) should do so on a timely basis, ensuring that, by all reasonable definitions, there is time for approval to be given before he or she takes the first interim examination. In this, he or she should take full account of the period within which the board of examiners is entitled to decide (see Article 14, paragraph 1). The request shall be accompanied by a clearly argued motivation, and, if necessary, by material that supports it.
2 Students shall submit to the examinations board any requests for exemption from an interim examination or practical exercise as intended under Article 17 of the CER. The examinations board shall decide on this after taking advice from the student counsellor. The periods within which decisions shall be taken are defined in Article 15, paragraph 2 of these Regulations and Guidelines.
3 If a student wishes to depart from the teaching programme prescribed in the implementation procedures, he or she shall submit a request to this effect, ensuring that, by all reasonable definitions, there is time for approval to be given before the date of the first interim examination that deviates

from that programme. In this, full account should be taken of the period within which the board of examiners is entitled to decide (see Article 13, paragraph 1).

4 A decision to withhold approval for a request of the type intended u... ...aragraphs 1, 3 and 4 of this Article must be fully motivated by the Examinations board, and may ...de after the student has been given the opportunity of a hearing, where the student ma... ...he assistance of the student counsellor.

5 The student will immediately be informed in writing of a decision or ... matters intended under paragraphs 1, 2, 3 and 4 of this Article. If the examinations b... ...ned has not made a decision during the time period prescribed in article 14, paragraph ...wise during the period of adjournment, approval will be understood to have been granted.

Article 15 TIME PERIODS

1 A decision on a request such as those described in Article 13, parag... ...shall be made within 40 working days of its receipt; or, if the request was submitted eith... ...academic holiday or within a period of three weeks before the start of an academic h... ...ll be made within a period of 40 working days after the end of the holiday. The examina... ...may adjourn a decision for no more than 10 working days. The student will be not... ...g of any such adjournment before the end of the 40-day period specified in the fi... ...of this paragraph.

2 The provisions of the previous paragraph will also be applicable to ... ...h as those described in Article 13 paragraph 3, on the understanding that the time period v... ...the moment that the recommendations of the student counsellor have been submitted. T... ...counsellor shall submit these recommendations to the examinations board no more than 1... ...ys after receiving the student's request.

Article 16 RIGHT OF APPEAL

Within four weeks of the event in question, students can appeal to the examinat... ...s board against the following: a ruling by the examinations board, a ruling by an examiner, or their t... ...uring an examination as defined in Article 7.60 WHW.

Article 17 MODIFICATION OF THESE REGULATIONS A... LINES

No decision shall be made in respect of the current academic year, unless, by all... definitions, it is unlikely to damage the interests of students.

Article 18 DATE OF COMMENCEMENT

These regulations will come into effect on 1 September 2005.

Approved by the board of examiners of the Master's programme Systems and Control.

6.4 Lecturers

Name	Phone[1]	E-Mail	Room	Buidling[2]
Babuška, prof. dr. R.	85117	r.babuska@dcsc.tudelft.nl	8C.3.18	3mE
Bombois, dr. ir. X.J.A.	85150	x.j.a.bombois@dcsc.tudelft.nl	8C.2.20	3mE
Boom, dr .ir. T.J.J. van den	84052	t.j.j.vandenboom@dcsc.tudelft.nl	8C.3.09	3mE
Bosgra, prof. ir. O.H.	85610	o.h.bosgra@dcsc.tudelft.nl	8C.0.09	3mE
Dekker, dr. ir. A.J. den	81823	a.j.dendekker@dcsc.tudelft.nl	8C.2.10	3mE
Dijkstra, dr. S.	85606	s.dijkstra@dcsc.tudelft.nl	8C.0.01	3mE
Eijk, prof. dr. ir. J. van	85396	j.vaneijk@3me.TUDelft.nl	5A-0-28	3mE
Hellendoorn, prof. dr. ir. J.	89007	j.hellendoorn@dcsc.tudelft.nl	8C.2.12	3mE
Heuberger, dr. P.S.C.	85331	p.s.c.heuberger@dcsc.tudelft.nl	8C.2.17	3mE
Hof, prof. dr. ir. P.M.J. Van den	84509	p.m.j.vandenhof@dcsc.tudelft.nl	8C.2.8	3mE
Huesman, ir. A.	88131	a.huesman@dcsc.tudelft.nl	8C.2.18	3mE
Klaassens, dr. ir. J.B.	82928	j.b.klaassens@dcsc.tudelft.nl	8C.3.21	3mE
Klein Woud, prof. ir. J.	81556	J.KleinWoud@3me.tudelft.nl	7-1-121	3mE
Scherer, prof. dr. C.W.	85899	c.w.scherer@dcsc.tudelft.nl	8C.2.22	3mE
Scherpen, dr. ir. J.M.A.	86152	j.m.a.scherpen@dcsc.tudelft.nl	8C.3.22	3mE
Schutter, dr. ir. B. De	85113	b.de.schutter@dcsc.tudelft.nl	8C.2.11	3mE
Teerhuis, ir. P.C.	85246	p.c.teerhuis@dcsc.tudelft.nl	8C.0.02	3mE
Verdult, dr. ir. V.	85768	v.verdult@dcsc.tudelft.nl	8C.2.23	3mE
Verhaegen, prof. dr. ir. M.H.G.	85204	m.h.g.verhaegen@dcsc.tudelft.nl	8C.2.25	3mE
Vries, ir E.J.H. de	86980	e.j.h.devries@dcsc.tudelft.nl	8C.0.03	3mE
Weiden, dr. ir. A.J.J. van der	85609	a.j.j.vanderweiden@dcsc.tudelft.nl	8C.0.04	3mE
Wieringa, prof. dr. ir. P.A.	85763	p.a.wieringa@3me.tudelft.nl	8C-1-13	3mE
Dankelman, prof. dr. J.	85565	j.dankelman@3me.tudelft.nl	8C-1-20	3mE
Grievink prof. ir. J.	84351	j.grievink@tnw.tudelft.nl	0.411	TNW-stm
Helm, prof. dr. F.C.T. van der	85616	f.c.t.vanderhelm@3me.tudelft.nl	8C-1-19	3mE
Mulder, prof. dr. ir. J.A.	85378	j.a.mulder@lr.tudelft.nl	031	LR
Olsder, prof. dr. G.J.	81912	g.j.olsder@its.tudelft.nl	HB 06.270	ITS
Stoorvogel, prof. dr. A.A	81912	a.a.stoorvogel@tue.nl	HB 06.270	ITS
Heijnen, prof.dr.ir. J.J.	82341	j.j.heijnen@stm.tudelft.nl	1.513	TNW-bt
Zuijlen, prof.dr. H.J.van	82761	h.j.vanzuijlen@citg.tudelft.nl	5.71	CiTG-ct

[1] For other phone numbers the student can call the universal TU number (015 27 89111) or the reception of the faculty (015 27 86666)

[2] Phone numbers in full are 015-27.....

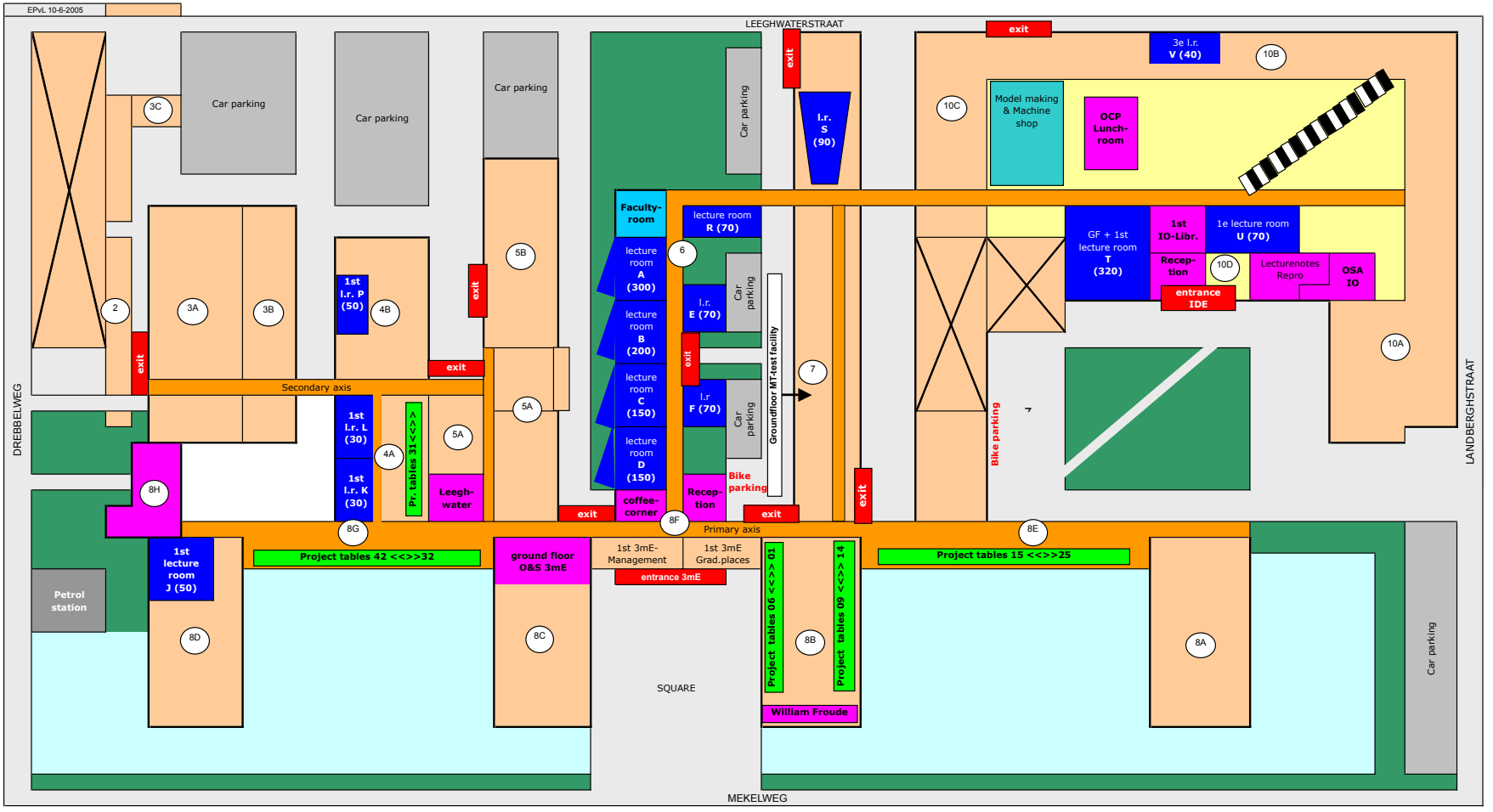
API: Leeghwaterstraat 44, 2628 CA Delft
CiTG-ct: Stevinweg 1, 2628 CN Delft
ITS: Mekelweg 4, 2628CD Delft
LR: Kluyverweg 1, 2629 HS Delft
TBM: Jaffalaan 5, 2628 BX Delft
TNW: Lorentzweg 1, 2628 CJ Delft
TNW-stm: Julianalaan 136, 2628 BL Delft
TNW-bt: Julianalaan 67, 2628 BC Delft
3mE: Mekelweg 2, 2628CD Delft

6.5 Campus Map

Legend Campus map

3	Faculty Applied Earth Sciences	36	Faculty Electrical Engineering, Media and Knowledge technology, Technical Computer Science and Technical Mathematics
5	Faculty Life Science and Technology, Botanical Garden	34	Faculty Mechanical, Maritime and Materials Engineering (3mE), Board of Governors, Staff Board of Governors, TopTech Courses
6	VSSD	37	Sports center
7	Alumni Desk, Facilitating Service	38	Cultural Center 'Mekelweg 10', Studium Generale
10	Master of Science International Programme	40	Faculty Technical Material Sciences
12	Faculty Chemical Technology	41	Service Technical Support
20	Auditorium, Congress center, University foundations Delft, TU Shop	43	Energy and Building Management
21	Library TU Delft, Delft University Press	45	Doc Vision Support Center Delft
22	Faculty Technical Physics	46	Machinery design for the process industry
23	Faculty Civil Technology, Management center for International Cooperation	52	Faculty Geodesy
24	Faculty Architecture	60	Logistics and Milieu Services
31	Faculty Technical Management Science	62	Faculty Aerospace Engineering
32	Faculty Industrial Design		

A description and the exact adresses of all the numbers can be found on the homepage of the TU Delft. In this table are only the numbers published which are of interest for the student of the MSc course Systems and Control.



3A	3mE Dep. Materials Science & Engineering (from june 2006)
3B	3mE Dep. Materials Science & Engineering (from june 2006)
3C	3mE Formula Student, NUNA, etc.
4A gf	3mE Mechanical Engineering design studio's and BSc project tables
4A 1st	3mE Labs Mechatronics + PC-rooms
5A	3mE Dep. Precision Micro-systems Engineering
5A	3mE Dep. Delft Center for Systems & Control
5B	3mE Dep. Proces & Energy
6	3mE Lecture rooms A - F + R + Faculty room
7 gf	3mE Marine & Transport Technology (Test Facility)
7 1st	3mE Marine & Transport Technology (Marine Technology)
8B gf	3mE BSc Project tables + William Froude
8B 1st	3mE Marine & Transport Technology
8B 2nd	3mE Dep. Precision Micro-systems Engineering
8B 3rd	3mE Dep. Precision Micro-systems Engineering
8B 4th	3mE Dep. Precision Micro-systems Engineering
8C gf	3mE Offices O&S and M&C
8C 1st	3mE Dep. Biomedical Engineering
8C 2nd	3mE Dep. Delft Center for Systems & Control
8C 3e	3mE Dep. Delft Center for Systems & Control
8C 4e	3mE Dep. Delft Center for Systems & Control
8D gf	3mE Graduation places
8D 1st	3mE Dep. Materials Science & Engineering (from june 2006)
8D 2nd	3mE Dep. Materials Science & Engineering (from june 2006)
8D 3rd	3mE Dep. Materials Science & Engineering (from june 2006)
8D 4th	3mE Dep. Materials Science & Engineering (from june 2006)
8E	3mE BSc project tables
8F bg	Reception WbMT
8F 1st	3mE management + graduation places
8G	3mE BSc project tables
8H	TUD University Board
10A bg	IDE PC-clusters
10A 1e	IDE Design Studio's DE
10A 2e	IDE Design Studio's + lab. DE
10A 3e	IDE DE
10A 4e	IDE DE
10B bg	PMB Welding Shop + ware house
10B 1e	IDE Design Studio's
10B 2e	IDE labs ID
10B 3e	IDE ID
10B 4e	IDE ID + PIM + study advisor + FM
10C bg	IDE Modelmaking & Machine Shop
10C 1e	IDE Photographer + AV-supplies
10D bg	IDE recept. + O&S + Copy Shop
10D 1e	IDE Library