Master guide 2012/2013 – APPLIED MATHEMATICS

UNIVERSITY OF TWENTE.

Faculty of Electrical Engineering, Mathematics and Computer Science

Applied Mathematics
Computer Science
Electrical Engineering
Embedded Systems
Human Media Interaction
Systems and Control
Telematics

www.utwente.nl/ewi/en/education

Welcome

Mathematics is one of the oldest branches of science. Applied mathematics or – as we like to call it – Engineering Mathematics distinguishes itself from pure mathematics in that it derives inspiration for its own development from 'contact' with such related fields as physics, astronomy, chemistry, biology, economics, computer science and many more. As a matter of fact, mathematics – and certainly applied mathematics – has in large part developed in response to the need to be able to formulate and solve questions in those fields. In short, it is the language for communication par excellence.

The Department of Applied Mathematics offers an environment where you specialize in modern mathematical techniques with the aim of being able to make substantial contributions in any environment where tools from mathematics are applied. An external traineeship is therefore considered an essential part of the curriculum of the two-year Master's programme.

Right from the start, every Master's student is a junior researcher in the chair of his or her own choice. In addition to a common curriculum, specialized courses are offered by each chair of the department. During the final phase of the programme, students conduct research under the supervision of one of the members of the chair.

A Master's degree in Applied Mathematics will open a great many doors in your future career. Regardless of whether you are eventually employed by a private company, a research institute or a university, a Master's degree in Applied Mathematics represents a crucial step in your development, making you a highly prized professional.

Dr. Jan Willem Polderman

Programme Director

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APPLIED MATHEMATICS

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SECTION A

Master's programme

Department of Applied Mathematics

Since 2002 Applied Mathematics is a department in the Faculty of Electrical Engineering, Mathematics and Computer Science (EEMCS). The department is organized into chairs, each covering a distinguishing part of the broad field of applied mathematics. In addition to being involved in scientific research, the Applied Mathematics Chairs are also responsible for the curriculum of the Bachelor of Science (BSc) and Master of Science (MSc) mathematics programmes (design and teaching) and service teaching in mathematics, which amounts to a substantial part of all teaching at the University of Twente.

1 APPLIED MATHEMATICS
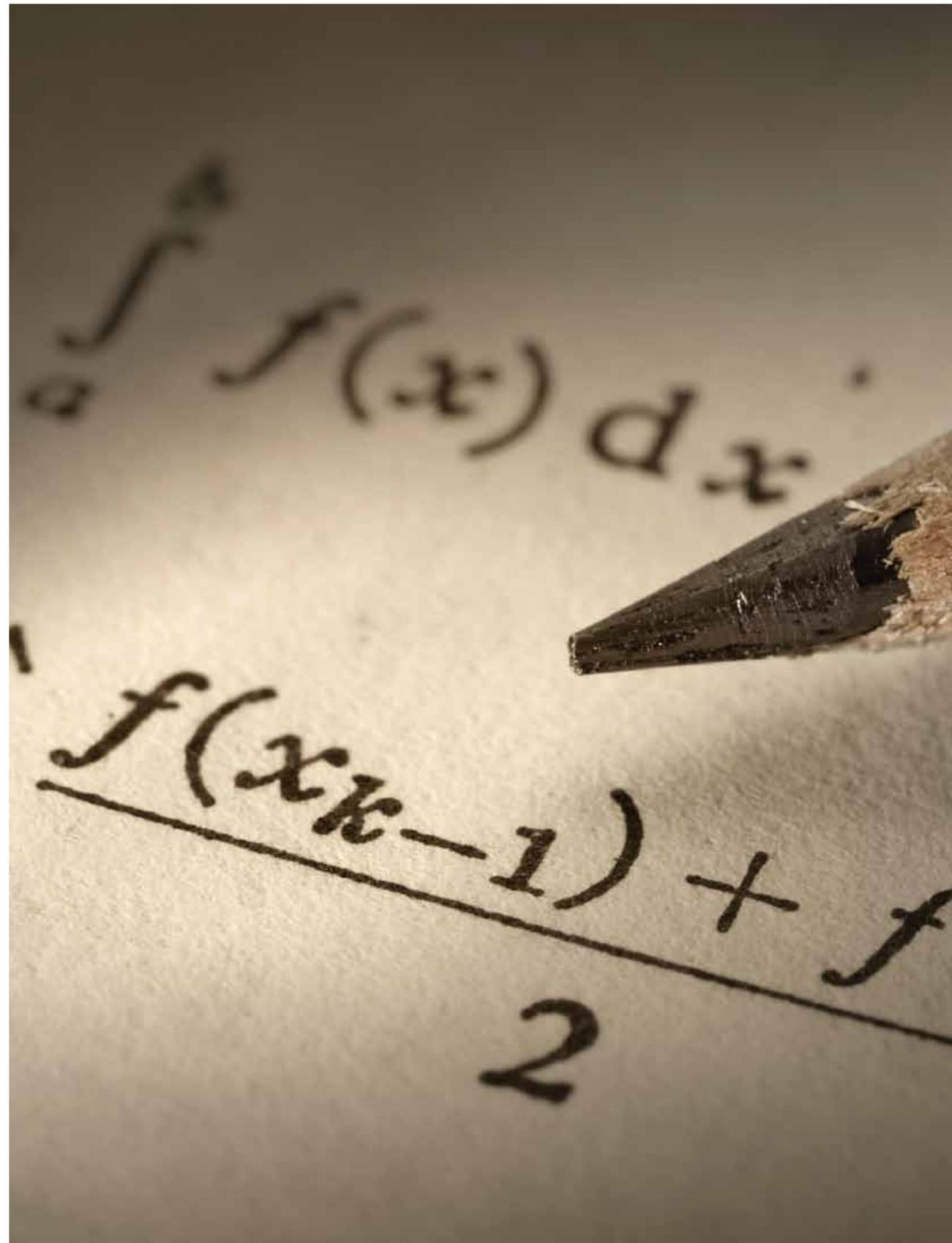
1.1 GOALS AND AIMS

The programme Applied Mathematics has the following aims:

1. To teach students modern, advanced mathematical knowledge with an emphasis on its application to problems in their chosen field of specialization;
2. To give students an understanding of the methods and techniques of their field and of the position their field occupies within the broader fields of science;
3. To help students acquire the skills and develop the attitude necessary to function at the academic level. This includes the skills that are needed to be able to communicate effectively and to collaborate with researchers in flanking disciplines both individually and as part of a team;
4. To raise students' awareness of the social context and social impact of research and developments in their field;
5. To give students the opportunity to acquire the knowledge, attitude and skills that will enable them to continue on an academic path leading up to a doctorate programme and degree (if willing and able).

In working to achieve these aims, attention is explicitly focused on alignment with both national and international standards, on reflection on science, technology and society (this is explored in the traineeship, for example, when students are expected to reflect on the working environment), on presentation and on the feasibility of the programme from the student's point of view.

1.2 GENERAL OUTLINE

The master's programme is a two-year programme. The programme is organized in semesters. Each semester contains 20 weeks, and is subdivided in quartiles. The unit of credit is the European Credits (EC). One EC stands for 28 hours of study-load. An academic year is 60 EC. The master's programme is 120 EC.

1.3 PROGRAMME

The educational profile of the programme is characterised on the one hand by the three specializations within the programme and by the attention paid to mathematical modelling on the other. The three specializations are engrafted on the corresponding three fields of research of the Department of Applied Mathematics, which can be characterised by the following key words:

1. Mathematical Physics and Computational Mechanics (MPCM): Mathematical Modelling of Waves, Neurodynamics, Inverse Problems in Seismology, Integrated Optics, Numerical Analysis, Turbulent Flows, Computational Fluid Dynamics.
   The chairs of this specialization are Applied Analysis and Mathematical Physics (AAMP) and Numerical Analysis and Computational Mechanics (NACM);
2. Industrial Engineering and Operations Research (IEOR): Combinatorial Optimisation, Mathematical Programming, Supply Chain Management, Queuing Theory, Telecommunications Networks, Industrial Statistics. The chairs of this specialization are Stochastic Operations Research (SOR) and Discrete Mathematics and Mathematical Programming (DMMP).
3. Mathematics and Applications of Signals and Systems (MASS): Nonlinear and Robust Control, Hamiltonian Modelling of Open Physical Systems, Hybrid Systems, Distributed-Parameter

Systems, Stochastic Filtering and Control. The chair of this specialization Hybrid Systems (HS).

Students choose a chair within a specialization. During the final phase of the master's programme, the students act as 'junior members' of the chair they have selected. It is during this phase that the students are given the greatest opportunity to demonstrate that they have acquired the qualities outlined in Article 4 of the Education and Examination Regulation by the time they complete their studies.

1.3.1   Mathematical Physics and Computational Mechanics (MPCM)

The engineering mathematician is involved in the development and application of mathematical tools for solving problems that arise in physical or technical systems. Related to the rather broad scope of applications, there is a need for correspondingly diverging specializations. Mathematical Physics and Computational Mechanics mean a unique combination of both fundamental and applied aspects of mathematics.

This results in advanced courses in a variety of mathematical topics, mathematical modelling, joint courses with other disciplines, and a final research project in a company or research institute in The Netherlands, or at the university. The flexible programme setup can be tailored to the individual participants. Each student can count on extensive coaching and tutoring by one specific faculty member who will supervise, guide and support the student throughout the study. Herewith also special attention is given to the cultural and social needs of the student.

Chair: Numerical Analysis and Computational Mechanics and Applied Analysis and Mathematical Physics (AAMP).
Chair holders: NACM: Prof. J.J.W. (Jaap) van der Vegt
Room: Citadel 315, Phone: 053 489 5628;
E-mail: j.j.w.vandervegt@utwente.nl

AAMP: Prof. S.A. (Stephan) van Gils

Room: Citadel 325, Phone: 053 489 3410

E-mail: s.a.vangils@ewi.utwente.nl

Intended for transfer students (students with a bachelor's degree in Technical Mathematics from one of the 3TU universities): who start the master's programme in the 2012-2013 academic year.

Programme requirements: the course section of the master's programme will certainly consist of:
- three common subjects (C),
- five mathematics subjects (relevant for the specialisation)
- one reflection course (R),

plus electives so the entire course programme adds up to at least 60 EC and at least two of the 3TU electives (2N) are selected.

These programme requirements result in the following (compulsory) course programme:

Code	Course	Quartile				EC	Remark
		1	2	3	4		
191506302	Applied Functional Analysis	x				6	C
191551200	Scientific Computing			x		6	C
191570401	Measure and Probability	1/3					C
191616040	Philosophy of Engineering		x		x	5	R
191551150	Numerical Techniques for PDE		x			5	
191551161	Applied Finite Element Methods for PDE's			x, 2N		6	
191560430	Nonlinear Dynamics		x			5	
191551091	PDE I (Theory of FEM)			x		6	
191560371	PDE II (Variational Analysis & Asymptotics)				x	5	

2N	Choice of one national course

The electives are applied physics/technology subjects from Optics, Fluid Dynamics, Biomathematics or other mathematical subjects that may be offered nationally. These subjects are determined in consultation between the student and the respective chair holder. The choice depends on the student's interests and the topic of the final project (master's thesis).

It is also possible for the traineeship (20 EC) to be used to delve more deeply into specific subject matter.

Students entering the programme through an alternative route: Students with a bachelor's degree other than Technical Mathematics from one of the 3TU universities are asked to contact the programme mentor as soon as possible in order to determine a suitable programme that is feasible from the student's point of view.

A list of possible elective couses are given below. This list is not complete but gives a good indication of what is available.

Course	Quartile				EC	Remark
	1	2	3	4		
Capita Selecta AACS (Seminar Mathematical Physics)	x	x	x	x	5	Applied Math course
Time Series Analysis	x			x	5	Applied Math course
Continuous Optimization		x			5	Applied Math course
Stochastic Differential Equations		x		x	6	National
Advanced Modeling in Science		x		x	6	National
Dynamic Behavior of Neuronal Networks				x	5	
Physica van Vloeistoffen			x		5	
Advanced Fluid Mechanics				x	5	
Mathematical Biology		x			8	National (if available)

1.3.2 Industrial Engineering and Operations Research (IEOR)

Industrial Engineering and Operations Research is supported by the two chairs: Discrete Mathematics and Mathematical Programming, and Stochastic Operations Research, with a strong international reputation in fundamental research and education in the areas of operations research and statistics and their applications in telecommunications, logistics and reliability. Research is concentrated in the Centre for Telematics and Information Technology. The specialization IEOR provides a scientific attitude, combined with the necessary engineering skills to tackle problems in the broad area of operations research and statistics as an expert in at least one sub-area such as queuing theory, game theory, scheduling, combinatorial optimization, nonlinear programming or graph theory.

The specialization consists of a one-year course programme, followed by one year of practical training (traineeship), and graduation (master's thesis). It is possible to include some courses in the programme for the second year.

Requirements
Course load   : 60 ECs
Traineeship   : 20 ECs
Thesis   : 40 ECs

Courses:

Compulsory course:

191616040: Philosophy of Science (Quartile 2 and 4): 5 EC.

Three courses from the 3TU mathematics core programme

Code	Course	Quartile				Credit
		1	2	3	4	
191570401	Measure and Probability	36				6
191506302	Applied Functional Analysis	23, 36				6
191531750	Stochastic Processes	23, 36				6
191551200	Scientific Computing			23, 36		6
191581100	Discrete Optimization	2N, 36				6
191581200	Continuous Optimization	2N, 36				6

23	Choice of 2 out of 3
36	Choice of 3 out of 6
2N	Choice from the national courses

Five courses from the IEOR programme selection list

Code	Course	Quartile				Credit
		1	2	3	4	
191521800	Game theory	X				5
191531940	Networks of Queues				X	5
191531920	Markov decision theory and algorithmic methods		X			5
2012 ???	Capita Selecta Operations Research				X	5
191531870	Queueing Theory (LNMB)			2N		6
191580800	Scheduling (LNMB)			2N		6
191581100	Discrete Optimization (LNMB)	2N, 36				6
191581200	Continuous Optimization (LNMB)	2N, 36				6
191581420	Optimization Modelling			X		5

Remaining course load:

Free selection from Industrial Engineering master's courses, national mathematics master's courses (mastermath), master's courses at other universities and PhD courses.

1.3.3 Mathematics and Applications of Signals and Systems (MASS)

Chairs: Hybrid Systems (HS)

The engineering mathematician is involved in the development and application of mathematical tools for solving problems that arise in technological systems. Modern technologies increasingly rely on complex systems to reach their functionality. Mathematical systems and control theory is concerned with the mathematical analysis of complex systems, as well their design by addition of control components (feedback), involving system components from various disciplines including electrical and mechanical engineering, computer science and process control. This results in advanced courses in a variety of mathematical topics, mathematical modelling, joint courses with other disciplines, and a final research project in a company or research institute in The Netherlands, or at the university.

The first year is divided into 4 quartiles and entails 10–12 courses of 5 or 6 ECs per course. The number of courses in the second year is flexible (possibly zero). Some of the courses are compulsory.

Code	Course	Quartile				EC	Chair
		1	2	3	4		
191561560	Systems and Control	56, 2N				6	HS
191560671	Robust Control			56		5	HS
191571200	Hybrid Dynamical Systems				56	5	HS
191571090	Time Series Analysis and System Identification	56				5	HS
201200135	Random Signals and Filtering			56		5	HS
191571501	Stochastic Differential Equations			56, 2N		6	HS
191616040	Philosophy of Engineering		x		x		
191506302	Applied Functional Analysis	23, 36				6	
191531750	Stochastic Processes	23, 36				6	
191551200	Scientific Computing			23, 36		6	
191570401	Measure and Probability	36				6	
191581100	Discrete Optimization	36, 2N				6	
191581200	Continuous Optimization	36, 2N				6	
191509103	Advanced Modeling in Science			2N		6	AAMP
191551161	Applied Finite Element Methods for PDE's			2N		6	NACM
191531400	Applied Statistics			2N		6	HS
191531870	Queuing Theory			2N		6	SOR

23	Choice of 2 out of 3
2N	Choice from the national courses
36	Choice of 3 out of 6
56	Choice of 5 out of 6, with the three courses from the chair of your choice being compulsory

Other courses may be chosen from the tentative list below. This list is not complete but gives a good indication of what is available. The choice depends on your background and preferences and the content of the graduation project.

Course	Quartile				EC	Comment
	1	2	3	4		
Optimal Control			X		5	Applied Math course
Modeling and Analysis of Concurrent Systems 1	X				5	Computer Sciences course
Modeling and Analysis of Concurrent Systems 2		X			5	Computer Sciences course
System Validation				X	5	Computer Sciences course
Advanced Digital Signal Processing				X	5	Electrical Engineering course
Control Engineering			X			Electrical Engineering course
Digital Control Engineering	X				5	Electrical Engineering course
Engineering System Dynamics			X		3	Electrical Engineering course
Modeling and Simulation		X				Electrical Engineering course
Modern Robotics				X	5	Electrical Engineering course
Biological Control Systems	X					Technical Medicine course
Infinite Dimensional Systems						National (if available)
Nonlinear Systems Theory						National (if available)

1.3.4   Twente Graduate School

The Twente Graduate School at the University of Twente offers an increasing variety of integrated master's and PhD programmes for outstanding graduate students who aim at a career in scientific research. The programmes are set up in cooperation between faculties and research institutes. Through a broad selection of compulsory and elective courses, students are able to specialize in a research area of their interest and at the same to broaden their perspective on the societal context of technology and research. All these aspects are integrated into the Twente Graduate School (TGS) which aims to become a breeding ground for research talent. TGS sets high standards and has a strict selection procedure for both research and education programmes as well as prospective students.

The structure of a graduate research programme includes a cursory component at master level that forms the basis for research concerning the subject in question, an international orientation on research, a preparatory and orientating master's project, a cursory component provided by the involved research institute, the national research schools and/or other (inter)national networks, a number of broadening subjects such as ethics and philosophy, innovation and entrepreneurship, governance and project management, science and communication, etc., and a research project resulting in a doctoral degree.

A schematic overview of the building blocks of a graduate research programme:
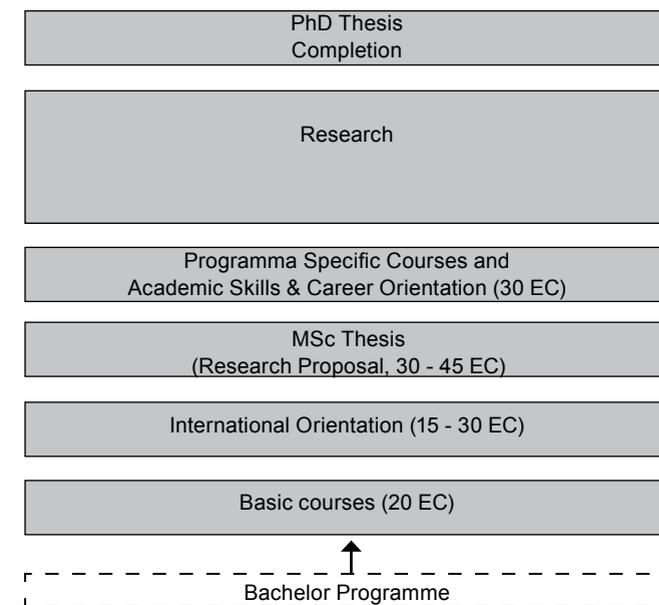
For the master's programme of Computer Science, TGS has four specializations. In the following paragraphs each specialization will be described.

1.3.4.1 Computational Science
During the past decades Computational Science has become an increasingly important component in understanding and controlling the key mechanisms in the natural-, biological- and technical sciences. This field of research consists of the combination of mathematical and physical modelling and analysis, large-scale simulation and the development and application of accurate high-performance computational algorithms. Future challenges in Computational Science concern the development and analysis of methods in which physical, chemical and biological processes at a wide range of length- and time-scales are simultaneously and consistently integrated.

The Computational Science programme will provide the academic context for successful researchers in its multi-disciplinary field, combining aspects of mathematics, physics, chemistry, mechanics and computer science. Many of the applications require a deep understanding of nonlinear phenomena, their interactions at various scales and sensitivity of model predictions. That line of issues will also be reflected in the design of the program, with full embedding in the MSc courses of Applied Mathematics, Applied Physics, Chemical Engineering and Mechanical Engineering.

The main challenges to teaching and research in the Computational Science program are:
- to arrive at a systematic 'first principles' approach to modelling, simulation, analysis and control of complex nonlinear dynamic behaviour, with particular attention to problems evolving on many length- and time-scales simultaneously;
- to include and interpret the full variety of interacting physical mechanisms that govern the multiple physical processes that take place, as well as their coarsened approximations in heterogeneous multiscale formulations;
- to achieve leading capability in high-performance computing and highly accurate numerical methods;
- to apply computational modelling methods to multi-disciplinary problems of factual practical relevance, linked to a variety of problems and applications in the natural-, biological- and technical sciences and in engineering.

Teaching and training of the students will integrate key courses from the contributing MSc tracks to provide a solid basis for a successful research attitude.

Programme mentor:
Prof. dr. S.A. van Gils
Room: Citadel H 325; Phone: 053 489 3410; Email: s.a.vangils@utwente.nl.

Detailed Programme
Year 1
Basis courses (20 EC) Course   *Effort*

Course	Effort
Advanced Programming in Engineering and Science	5 EC
Numerical Solution Methods for Partial Differential Equations	5 EC
Advanced Fluid Mechanics	5 EC
Nonlinear Dynamics	5 EC

Year 2
International Orientation
The students will spend a period of 3 months at a laboratory for high-performance computational modeling and analysis, outside the Netherlands. The subject of the internship will be coordinated with the supervisor in such a way that it is in line with the character of the selected theme for the MSc thesis work of the particular student. This adherence to an underlying theme for each student will provide the necessary level of expertise and specialization in an otherwise multi-disciplinary programme.

MSc Thesis (Research proposal)
The partner groups have ample experience in developing interesting topics for research that train the students at advanced levels, including regular presentations at international venues and publication in scientific journals. In the course of the second year ample attention will be given to train students in literature search and evaluation, and, in deepening the central research questions that are at the basis of the PhD proposal. This proposal will be delivered as part of the Master's thesis phase.

1.3.4.2 Industrial Engineering
IE is concerned with the design and improvement of operational and strategic processes and integrated systems. These processes or systems provide products or services to customers or to the society at large. The design and improvement of processes and systems considers multiple goals concerning time, money, materials, energy and other resources. Several organizations and multiple stakeholders often are involved (supply chains, alliances, public-private partnerships) and governance structures can be part of design and improvement initiatives.

IE is used in a variety of fields, such as manufacturing, logistics, product development, construction, information and telecommunication, finance, energy, transportation and healthcare. The term "industrial" can be misleading; this does not mean just manufacturing. It encompasses service industries as well. It has long been known that industrial engineers have the technical training to make improvements in a manufacturing setting. Now it is becoming increasingly recognized that these same techniques can be used to evaluate and improve productivity and quality in a wide variety of service industries, as well as in the public sector.

IE is a field of engineering and one important element of its approach to the design and improvement of processes and systems is the use of quantitative methods. These are derived from fields such as operations research, management science, mathematics, economics, statistics, information systems, and engineering.

IE draws upon specialized knowledge and (analytical) skills in the mathematical, physical, and social sciences, together with the principles and methods of engineering analysis and design. Unlike traditional disciplines in engineering, IE addresses the role of human decision-makers and other stakeholders as key contributors to the inherent complexity of systems.

IEs are problem solvers. They work on real-world problems, combine disciplines, and develop project and process-management expertise and communication skills. IEs can have various undergraduate backgrounds in engineering and other quantitative fields. Key skills and qualities that they will need to possess are:

- Resourcefulness and creative problem solving
- Keen analytic mindset and modeling aptitude
- Good mathematics skills
- A fascination for technology and technological innovation
- Inquisitive mind and continuous desire to learn and improve
- Good common sense
- A strong desire for organization and efficiency
- Excellent communication, listing, and negotiation skills
- Ability to adapt to many environments, wear many hats, and interact with a diverse group of individuals

IE is also known as operations management, operations research, production engineering, or manufacturing engineering; a distinction that seems to depend on the viewpoint or motives of the user. In healthcare, for example, IEs are more commonly known as management engineers, engineering management, or even health systems engineers.

Programme mentor:

Prof. dr. R.J. Boucherie

Room: Citadel H 125; Phone: 053 489 3432; Email: r.j.boucherie@utwente.nl.

Detailed programme

Year 1 - 2

Core courses (22EC)

Course Effort

191531750 Stochastic Processes 6 EC

191581100 Discrete Optimization 6 EC

191515201 Mathematical Finance 5 EC

191820190 Supply Chain and Transportation Management 5 EC

Equalization courses (10EC)

Equalization courses are offered to enable students from a variety of bachelor's programmes to successfully complete each track.

Core courses (20EC)

Core courses are common for the entire IE Graduate Programme. These courses give a general overview of the research area (191515201, 191820190), and are of fundamental nature (191531750, 191581100)

Core and elective courses (45 EC)

Elective courses can be selected from a pool of common courses. Within the IE Graduate Programme courses from the programs Mechanical Engineering, Applied Mathematics, Industrial Engineering and Management, Civil Engineering and Management and Industrial Design Engineering may be selected.

The division of 60 EC between core courses, equalization courses and elective courses may differ per student.

International research orientation (15 or 20 EC)

International research orientation via internship or study period at international renowned institute.

Master's thesis project (at least 30 EC)

At least 30 EC Master's thesis project. This may be increased to 45 EC depending on the selection of core, equalization and elective courses. Research paper based on master's thesis.

1.4   PROGRAMME GUIDELINES

1. The master's programme is divided into four specializations. Each student chooses a specialization and – within that specialization – a course programme consisting of units of study.
2. The master's programme is a two-year programme. The curriculum for transfer students (who have a bachelor's degree in Technical Mathematics from a Dutch university) consists of the following elements:
   a. a minimum of 18 EC in common subjects (those with a tag 36 in the list, see section B of this study guide for a detailed overview) wherein a minimum of 12 EC should be from the core subjects (those with a tag 23 in the list);
   b. a reflection course of 5 EC.
   c. a minimum of 25 EC in Mathematics subjects in such a way that the golals of the programme are reached
   d. a minimum of 6 EC in national courses (offered via www.mastermath.nl);
   e. enough electives added to the above subjects so that the total number of EC adds up to at least 60;
   f. 20 EC traineeship and 40 EC final project.

In addition to the master's courses offered as part of the programme at the university , there are National courses offered and coordinated by the Mathematics Coordination Group. See www.mastermath.nl for a list of these. The examination rules and prerequisites are also posted on this website.

Section 1.3 provides further details on the master's programme for each specialization.

Alternative academic programmes are permitted in the second year:

> A combined traineeship and final project (60 EC), subject to a minimum of 3 and a maximum of 7 external months.

The rules and procedures governing the traineeship and the final project are specified in the following sections.

1. Students can create part of their own course programme using the units of study offered, with due observance of the provisions of Article 8.3 of the Education and Examination Regulations. The course programme must be approved by the study adviser and graduation supervisor. For students entering the programme through an alternative route, this is done at the beginning, while transfer students must have an approved course programme by the time they have earned 18 credits. The study adviser is entitled to approve a later change to the programme that is not to exceed 6 credits without the course programme approval procedure needing to be repeated. The units of study comprising the course programmes are annually determined for new students and, if necessary, changed for students further along in the degree programme. Each specialization is handled separately. This includes the scope and interrelation of units of study and the schedule of interim examinations. If changes are made, a transitional arrangement will apply to cohorts further along in the degree programme.

2. The schedule of interim examinations is posted on the website. Descriptions of subjects and their examination methods and prerequisites are provided at Black Board.

3. Students can also compile their own course programme (independent master's programme). A course programme like this requires the approval of the study adviser, graduation supervisor and the Board of Examiners. Before approving this programme, the Board of Examiners may confer with the programme committee.

4. The master programme for transfer students may contain a maximum of 10 EC in subjects of bachelor level (from outside mathematics education) if expertise in that area is so desired, for example in the final project.

International students and non UT BSc students

Students entering the programme through an alternative route may not use more than 20 EC from bachelor level courses to satisfy the programme requirements. They are explicitly encouraged to include common subjects in their study programme, which may be replaced by 'easier' versions from the bachelor's programme.

1.5 SPECIAL PROGRAMME COMPONENTS

1.5.1 Premaster

The master's programme in Applied Mathematics is meant not only for students with a bachelor degree in "Technische Wiskunde" but it is also very much suitable for students with a bachelor degree in other technical disciplines, where one always uses mathematics as a tool to get a better understanding of the related subject matter. With a master AM you can continue this quest and in a much more rigorous way. If, for instance, you are interested in Fluid Mechanics or Optics, the specialisation Mathematical Physics and Computational Mechanics has a lot to offer: from calculus of variation and dynamical systems to finite element methods and multi-scale computing. Does your interest lie in system theory and optimal control? Then the specialisation Mathematics and Applications of Signals and Systems is for you. Mathematical analysis and optimization of processes with uncertainties are in the heart of the specialisation Industrial Engineering and Operations Research. Health care sector is one such application area.

If any of these topics interests you, I would strongly advise you to speak to one of the chairmen of our department or the master coordinator, Pranab Mandal. They would work with you to find a suitable specialisation and help you make a list of relevant master courses matching your interests.

You would, of course, need some specific knowledge of mathematics to follow the master programme meaningfully. Some of it may already be part of your bachelor programme. If not, it is always possible to incorporate some of them in to your programme in the form of a "TW-minor". Furthermore, it is possible to incorporate some of the bachelor level courses in the master's programme itself.

Actual size of the premaster programme is very much dependent on the background of the student and in particular, on the (mathematics) courses already followed. For the students with a bachelor degree in a technical discipline, the size of the premaster is maximum 30 EC (most of the time it is 15 to 20 EC). The chosen specialization within the master's programme in Applied Mathematics also has an influence on the premaster courses.

Though a premaster programme is determined for each student separately, a general guideline is given below. The following courses are needed and/or useful in all the specialisations.

• Gewone Differentiaalvergelijkingen
• Analyse I

Other courses which are specific to different specialisations are as follows:

Mathematical Physics and Computational Mechanics (MPCM) and
Mathematics and Applications of Systems and Signals (MASS) :

• Complexe Functietheorie
• Signalen en Transformaties
• Inleiding Wiskundige Systeemtheorie

Industrial Engineering and Operations Research (IEOR) :

• Statistiek en Kansrekening
• Deterministische modellen in de OR
• Markovketens
• Mathematische Programmering

1.5.2 Traineeship

The traineeship is completed over a period of at least three months but no more than seven months. Students complete traineeship off-campus. Only in exceptional cases students may work as trainees at the University of Twente, such to be decided by the programme mentor, the graduation supervisor and the Board of Examiners.

During the traineeship (external training) you apply your knowledge that you acquired in your master's programme, working at a company or institution. The purpose is to work under circumstances, resembling the situation after your graduation as much as possible. Included in this working experience is also the process of finding a position and a short application procedure. The traineeship has a study load of 20 EC and will last therefore at least 14 weeks.

Organization

The following persons and organizations play a role during your external traineeship:

- The host organization, which is the company or institution where you will carry out the traineeship. The host organization assigns a staff member who will supervise your work.
- The Educational Supervisor is a lecturer of your master's programme. He/she will monitor the scientific level of your traineeship. The Educational Supervisor should give approval to the traineeship before you make your final appointments with the host organization. After the traineeship, he/she will carry out the final assessment and decide about the mark.
- The traineeship office. The office consists of the traineeship coordinator and the mediator. They will supervise the student from the beginning of the searching process finding a position until the end of the traineeship, when the last documents should be archived.

Eligibility

The following conditions must be met prior to definitive admission to the traineeship:

- The programme mentor has approved the student's course programme.
- A minimum of 40 credits has been completed from the approved course programme.
- The student has adequate mathematical knowledge to the satisfaction of the educational supervisor, the programme mentor and/or the external supervisor of the host organization.

Options for a traineeship

Many students will find a traineeship position at a company, but also an institution or uni-versity is possible. Internships can be done everywhere in the world, in Enschede but also in New Zealand or somewhere in between. "The sky is the limit", unless you manage to find a position with NASA or ESA as an astronaut. The only place on earth definitely out of scope is the UT itself. In all cases, the host institute should provide an assignment that must be approved by the educational supervisor. Approval will only be given if the assignment has sufficient academic level.

How to find a position

One might distinguish three ways to find a host institute:

1. The database of the traineeship office: the office maintains databases containing companies and experience reports: These reports are written by students and describe their experiences during the traineeship.
2. A lecturer in a chair (research group): during research, lecturers often cooperate with companies and institutions that might also be willing to provide a traineeship position.
3. On your own: it is possible and allowed to find a traineeship position on your own. Many companies offer traineeship positions on their websites. Finding a position in this way may not be easy but it may lead to a surprising and rewarding traineeship.

In all cases the traineeship must be approved by a lecturer before you make your final appointments with the host institute. This is described above.

Information sessions

Twice a year information sessions are held about the traineeship, in September and April. You can find them in the schedules of the master's programmes.

First contact

Make an appointment with the traineeship mediator (Stages@utwente.nl) if you start to think about a traineeship. During this meeting, a planning will be made for the preparation, the traineeship and the completion after return. See your mediator at least six months before you plan go. After this meeting, the Blackboard site with training positions will be opened for you.

Web references

Static information: www.utwente.nl/en/education/external_training/

Blackboard site with training position database: blackboard.utwente.nl.

Maarten Korsten (coordinator) Zilverling 1022 and Belinda Jaarsma (mediator): Zilverling 1018

Maarten Korsten   Belinda Jaarsma

1.5.3   Final Project

There are two types of final projects. The final project is either carried out separately (40 EC) or in combination with the traineeship (min. 30, max. 60 EC).

The final project must enable the student to apply the expertise gained during prior courses, projects and practical training sessions to solve well-defined problems of sufficient academic difficulty. In completing the final project, students must be allowed to make their own decisions. Students must be able to address the problem systematically, achieve clear results and formulate clear conclusions. Students are expected to report, both orally and in writing, on their findings and read and process relevant literature critically. Students who choose the combined traineeship and final project may use part of their credits to focus on the project theme before leaving and work on their report after their return.

At the beginning of the final project, the student and the graduation supervisor make work agreements. The graduation supervisor ensures that the assignment is in line with the 'mission' of the student's chosen specialization and arranges for adequate supervision. The student will meet with the supervisors regularly to discuss the progress of the final project. These meetings focus on both the content and the implementation of the final project (comparable to the job appraisal interviews students will encounter later in their career).

To complete the final project, the student must submit a written report and hold a public presentation.

Graduation committee and evaluation committee

The graduation supervisor puts together a graduation committee at the start of the final project. Besides the supervisor him- or herself, at least one other member of the research staff of TW has a seat on this committee. The supervisors are always part of the committee, which can also include outside members. The graduation committee meets at least three times to discuss the assignment progress and direction. At least two weeks in advance of the date of the final presentation, the graduation committee appoints an evaluation committee comprised of at least three members (often there are four or five). The exact rules regarding the formation of the evaluation committee are to be found in the "RET".

The members of the evaluation committee attend the final presentation and examine the report.

All the members of the evaluation committee discuss the presentation and report, after which the committee grades the entire project (implementation, presentation and report). If the final project has been combined with a traineeship, the traineeship and the final project are both graded.

Final project admission and eligibility

The student contacts a chair willing to take responsibility for the development, organization and supervision of the project and/or an external organization where the project can be performed. The programme mentor can help find a chair. The chair can be of assistance in making arrangements with external organizations. The following conditions must be met prior to definitive admission to the final project:

- The programme mentor has approved the student's course programme.
- A chair/chairs willing to take responsibility for the organization, supervision and assessment of the graduation project has/have been found.
- Outside of the final project or combined traineeship and final project, the student requires no more than 10 credits to be eligible for the master's programme final assessment.

Rules for supervising and evaluating final project

The graduation supervisor is responsible for ensuring that there is proper supervision and evaluation during the course of the final project.

One part of supervising would-be graduates is to create a graduation file where correspondence between the student and graduation committee is saved, along with the agreements made as a result.

The student ensures that his or her file includes reports of any obstacles beyond the student's control that he or she has encountered while working on the final project, such as special personal circumstances, changes at the company where the student is performing his/her project, inadequate facilities or requisite information not being available on time. The graduation committee and supervisors ensure that work schedules and all additional agreements with the student are kept in the file. In particular, the file also includes work done in advance of the student's departure for the traineeship location as part of a combined traineeship and final project. During the final evaluation of the final project, explicit consideration is given to the work included in

the file but the report does not necessarily have to describe that work in detail.

No later than 5 weeks before the final project is due, the student and graduation committee confer on the project's status. A report of this meeting is saved in the file and states the project due date (rescheduled if necessary), as well as any corrective changes to the project description and supervision. The student confirms that he or she approves of the report and the updated agreements. Any time an extension of more than a month is granted (not including holiday periods), a new report is inserted in the file no less than three weeks before the extension is to expire.

1.5.4 Teaching degree

The combined final assessment of the Applied Mathematics master's programme and the Mathematical Education specialization of the Science Education master's programme offer a unique opportunity. The Science Education master's programme (Mathematical Education specialization) and Applied Mathematics master's programme overlap to a great extent in terms of professional content. This enables students to obtain exemptions, which gives them time to complete a second master's programme after completing Science Education or Applied Mathematics.

For more information, please visit the educational programme's website:
www.utwente.nl/master/hbo/sec/studieprogramma/se/

Or contact:
Dr. N.C. (Nellie) Verhoef, lecturer in teaching methodology
Building: Vrijhof, room 417
Phone: 053-4893958
E-mail: n.c.verhoef@utwente.nl

1.6 ORGANIZATION

1.6.1 Programme director

The Applied Mathematics programme director is dr. J.W. (Jan Willem) Polderman; room Citadel H213; phone +3153 489 3438; e-mail j.w.polderman@utwente.nl

1.6.2 Programme Coordinator and Programme Mentor

The programme coordinator and programme mentor is dr. P.K. (Pranab) Mandal. He can be contact for questions about the programme. He is to be found in building Citadel room H229;
phone: +3153 489 2227, e-mail: p.k.mandal@utwente.nl.

1.6.3 Coordinator Internationalisation

Drs. J. (Jan) Schut is the coordinator internalisation. He can be contacted for issues related to internalisation and scholarship arrangements room: Zilverling A 108; phone 053 489 4350, e-mail j.schut@utwente.nl

1.6.4 Study Adviser

The study adviser is dr. P.K. (Pranab) Mandal; Citadel room H229, telephone +31 53 489 2227, e-mail: p.k.mandal@utwente.nl.

The study adviser for international students is T.H (Thea) de Kluijver, M.A. She can be contacted with questions about regulations within the faculty or university; study related issues or private matters that are of influence on study and/or well-being, room Zilverling 1003; phone: 053 489 3697; E-mail: t.h.dekluijver@utwente.nl
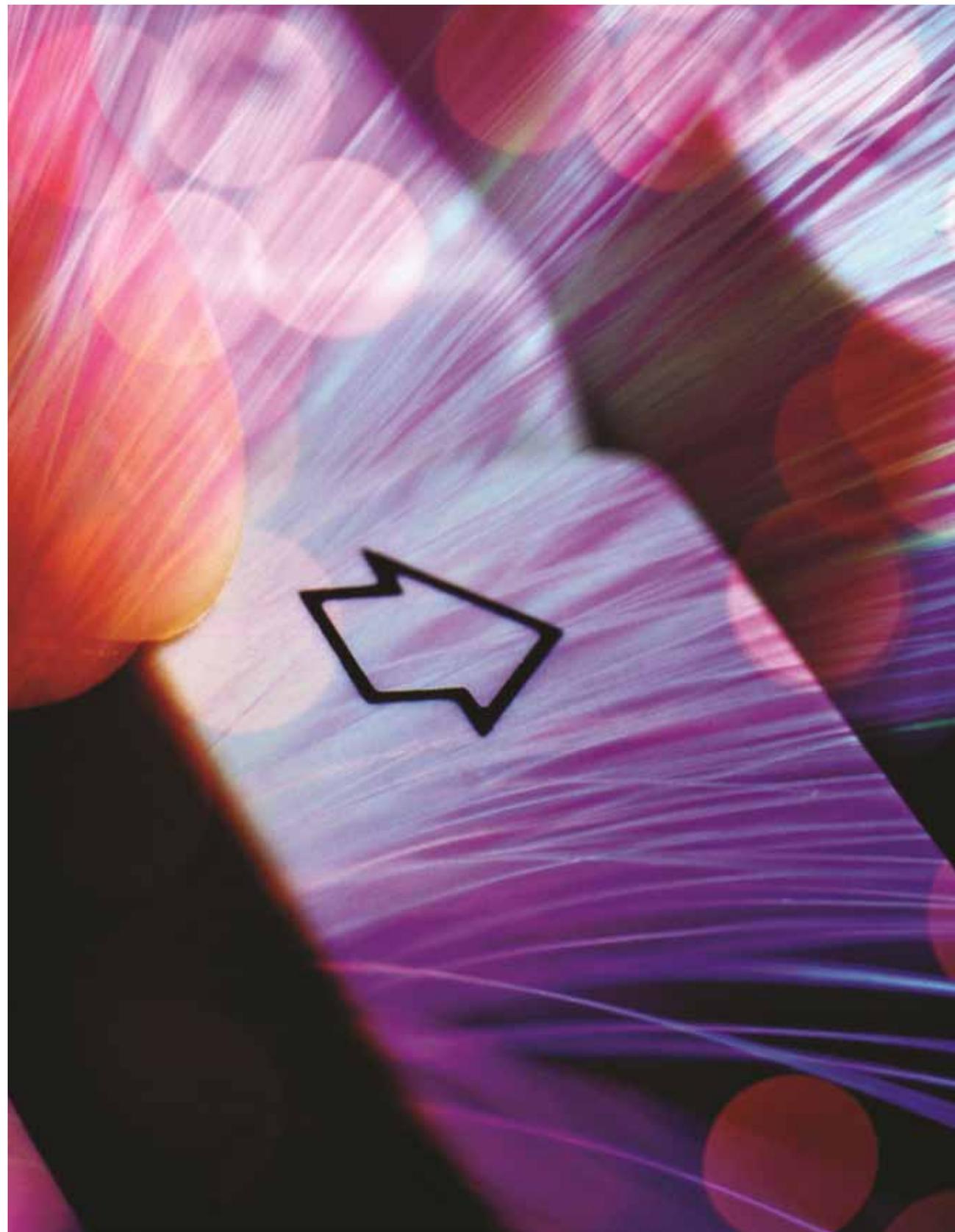

| J.W. Polderman | P. Mandal | T. de Kluijver | J. Schut |

2 CHAIRS

2.1 APPLIED ANALYSIS AND MATHEMATICAL PHYSICS (AAMP)

To work together with physicists and neurologists on very relevant problems in neuroscience is a great source of inspiration for Prof. Stephan van Gils. Not in the least as bright students join in to build up this collaboration.

'There are many fascinating questions in the natural sciences. Can we model cortical activity so well that we are able to produce epileptic EEG? If so, how do we extract information that helps the physician? In the water area: why does one tsunami, the one that affected Aceh in 2004, have so many disastrous consequences while another occurring not much later, affecting the island of Nias, has far less? It is fascinating that, although these questions do not seem to have anything in common, the math behind it is to a certain extent just the same.'

'Our research revolves around questions like the ones above. This is necessarily done in col-laboration with others. We often work together with the Hydrodynamic Laboratory, for example. Although testing ships using scale models may not seem a complicated matter, the increasingly stringent requirements that have to be met mean that future owners want practical test information. How do you simulate life-like waves?

Collaboration with neurophysiologists is essential to unravel the secrets of the brain. Unlike in physics, dynamics of the brain is not governed by 'standard' equations like the Navier Stokes equations for water waves or Maxwell's equations for electromagnetic waves.'

'We use the language of (partial) differential equations, often resulting in a numerical code, which is, in a sense, a model in itself. Many problems are of inverse type: can we tune parameters in the model such that certain behavior is recovered? For instance, forcing the water on one side of the water basin, such that prescribed behavior of the waves in the middle of the tank results. That is a challenging problem and also relevant for the testing of ships. One of the biggest problems in neurodynamics are the many unknown parameters for the wiring of the network, and also for the description of the many ionic channels that are present. Determining these parameters based on for instance micro recordings is a project for one of our PhD students.'

Prof. dr. S. A. van Gils

2.2 DISCRETE MATHEMATICS AND MATHEMATICAL PROGRAMMING (DMMP)

`MORE SOLUTIONS THAN THE NUMBER OF ATOMS IN THE UNIVERSE'

Most of us use public transport, drive cars, and use the internet without thinking of mathematics in the first place. But the design of schedules and timetables, the management of traffic flow in a street network, or the design of electronic marketplaces require mathematical models and solutions. In Discrete Mathematics we typically look at problems that are easily understood by everybody. But only with a deep understanding of the underlying mathematical structure, professor Marc Uetz and his group are able to devise algorithms that find provably good or even optimal solutions.

`In a nutshell, most discrete optimisation problems have only a finite number of solutions. One might be tempted to say: Ok then, just pick the best solution. But finite is relative: the number of possible tours to visit, say, the 100 largest European cities is finite, yet it exceeds the current estimate for the number of atoms in the universe by orders of magnitude. In order to solve such problems, we need algorithms considerably more clever than brute force.'

`In Discrete Mathematics and Mathematical Programming, we aim at the design of fast and clever algorithms to find solutions to all kinds of optimization problems, be it in telecommunication, production planning, healthcare logistics, or traffic control. To give one concrete example, together with Erasmus Medical Centre in Rotterdam and our colleagues from Stochastic Operations Research and Management, we are currently investigating how operating theatres can be used more efficiently, taking into account space, staff, and equipment.'

`Independent of the origin of the problem at hand, the challenge is to first understand the combinatorial structure and computational tractability of the problem. This may require methods from areas such as Graph Theory, Combinatorics, Mathematical Programming, Complexity Theory, and Algebra. Often, the key to success is exactly the combination of insights from several of these areas. This is a challenge, but also a lot of fun. As a result, the best results are usually achieved in teamwork of Mathematicians and Computer Scientists.'

`Practically speaking, what limits us is the fact that our computers are just too slow for brute force algorithms. And this problem persists, even if computer speeds double every 18 months as predicted by Moore's law. But things even get harder if the problem itself is a moving target: At an elevator, for example, new requests keep arriving anytime, yet decisions must be made immediately. Another challenge is decentralization: Modern infrastructure, the internet being the most prominent example, is often not managed centrally and requires coordination of locally selfish users. This is where Game Theory comes into play. The combination of Game Theory and Optimization has lately become an extremely hot topic. And again, a lot of fun.'

Prof.dr. Marc J. Uetz

2.3   MATHEMATICAL SYSTEM AND CONTROL THEORY   (MSCT)

'INTERACTION WITH THE OUTSIDE WORLD IS WHAT INTERESTS US'

His profession serves as the foundation of control engineering, robotics and mechatronics. In addition, computer scientists needing a solid mathematical basis to apply their models increasingly call in experts from the Mathematical System Theory group.

Systems theory is concerned with problems associated with the dynamic behaviour of systems in interaction with their environment. The basic problems driving modern day research and applications in systems and control are:

- Modelling: The search for suitable concepts and mathematical tools to describe dynamical systems in interaction with their environment. Furthermore, developing methods and algorithms for determining mathematical models on the basis of observations.
- Prediction: Predict future behaviour of a dynamical system on the basis of observations and a mathematical model.
- Control: Devising principles and algorithms to obtain a good controller or feedback processor so as to obtain desired behaviour of the system.

The field of systems theory is driven by applications. The goal, however, is to develop a successful and systematic approach to these problems in a comprehensive mathematical manner. Mathematical systems theory is concerned with the study of the central problems stemming from apparently diverse applications in a general setting. Thus the theoretical development concerns broad classes of models and problems. The ultimate goal is a general theory that, when specialized to specific applications, yields appropriate guidelines and tools. In contrast, in the areas of applications, research is motivated by specific engineering problems.

The strength of mathematical systems theory is, just like in other branches of applied mathematics, that problems are studied and analyzed decoupled from specific fields of application. The result is a theoretical framework that can be applied to diverse fields including electrical engineering, mechanical engineering, mechatronics, computer science and biology.

Mathematical systems theory uses a wide variety of mathematical tools such as linear algebra, functional analysis, automata theory, (partial) differential and difference equations, probability theory, stochastic processes, optimization, and numerical analysis. The field faces challenges in the mathematical theory of robust and optimal control, both in a classical and a hybrid context, modelling and control of physical systems, and design and analysis of embedded systems encountered in computer science. Systems and control theory plays an intrinsic role in a wide range of technological areas. There are two main reasons for the rise in importance of the field in the past decade. Firstly, demands on the performance of technical equipment and installations are increasing. Production processes require a constant high quality of the product under manageable process conditions, with low risks of calamities, low consumption of energy, and little pollution of the environment. Most of the modern high-tech equipment can only achieve this high quality when governed by a control system. Secondly, there is an increasing need for flexibility (for instance, changing characteristics of the product), which is also impossible to achieve without a control system.

Examples are audio and video equipment, cars, robots, airplanes, spacecraft, power plants, and communication systems. The availability of digital instruments and control devices at reasonable cost contributes strongly to a wide array of applications of systems and control theory.

Prof.dr. Anton A. Stoorvogel

2.4 NUMERICAL ANALYSIS AND COMPUTATIONAL MECHANICS (NACM)

'PRECISE, YET FEASIBLE CALCULATIONS'

Every day, Professor Jaap van der Vegt and his NACM-group are involved in 'calculation on the edge of possibility'. Numerical analysis translates physical reality into feasible simulation models.

'We develop numerical algorithms to solve mathematical problems, usually partial differential equations, which model problems in (geo)-physics, mechanical engineering, chemistry, life sciences and many other disciplines.' 'Weather predictions, for example, are only useful if they are calculated on time. Numerical weather prediction models have to be increasingly efficient and yield more precise results, but they must provide an answer in less than a day, otherwise they are useless. In addition, we also thoroughly examine the stability and convergence properties of numerical algorithms. This is crucial, since the algorithms are

generally very complicated. Analyzing simulation models therefore is a complicated mathematical challenge.'

'We frequently address questions from the field of computational mechanics, for example hydrodynamic problems, such as complex two-phase flows of air bubbles or solid particles in a liquid or gas, microstructure etching or electromagnetic waves in media. The mathematical equations of these physical problems are generally known, but they are difficult to solve because computer technology is not fast enough to compute all relevant physical scales. This requires the development of simplified models which preserve the essential features of the physics and the underlying mathematical structure, making it possible to perform realistic calculations in a reasonable time.'

'Numerical Analysis and Computational Mechanics students can choose from a wide variety of subjects, such as the development of new algorithms for a wide range of applications, but also research in the underlying mathematical theory such as questions regarding convergence and stability of the numerical algorithms.' 'When you are involved in Numerical Analysis, you are often exploring the edge of current technical possibilities, which is exciting. Besides, you are exploring realistic applications. Students can even introduce their own subjects and build a mathematical model in accordance with their own interests. That is what makes this field also perfect for physics, chemistry, mechanical and civil engineering students and students from other technical disciplines interested in taking a mathematical approach.'

prof.dr.ir. Jaap J.W. van der Vegt

2.5 STOCHASTIC OPERATIONS RESEARCH (SOR)

'CALCULATING PROBABILITIES AT THE HOSPITAL BEDSIDE'

How can the time-honoured Erlang theory developed in telephony help determine the required capacity of intensive care units? Prof. Richard Boucherie discovers interesting mathematical connections between application areas in Stochastic Operations Research. We all encounter Operations Research problems and "uncertainty" several times each day in our daily lives.

'Coincidence and uncertainty play a major role in determining the required number of beds in intensive care units in a region. The patient arrival process is largely a matter of coincidence, and exact demand is impossible to predict. However, to find the balance between costs and care, we need to find the optimal number of available beds. An approach used in telecommunications, the Erlang theory, offered useful clues as it deals with similar problems. This theory was developed at the beginning of the last century to model the required capacity of telephone exchanges. The connection may not be apparent at first, but the application of Erlang theory to hospital capacity planning nicely illustrates that mathematical models are rather generic.'

'Stochastic Operations Research is a branch of applied probability that involves a great deal of analysis and optimization problems. Waiting at a traffic light you are part of an OR problem. And how does Google yield the webpage you are looking for? An essential part of the answer is in Stochastic Operations Research. You will encounter our field in a wide range of applications.'

'Stochastic Operations Research traditionally addresses logistics, production and inventory problems, for example in production process optimization and in the use of game theory to determine a fair distribution of additional profits generated by companies cooperating in production and supply chains. In addition, a fair share of research focuses on telecommunications systems. Mobile telephony is almost a quintessential example of the application of queueing theory. Later generations of communication products rely to an increasing extent on "ad hoc" communication, involving decentralized communication devices. Is it nonetheless possible to assess the quality of these services? Together with the Netherlands Organization for Applied Scientific Research (TNO), we investigated Wireless LAN networks; complex systems in which the number of users present at any given time cannot be predicted. However, data must reach its destination within a given time. If we remove the non-essential features, a surprisingly simple queueing model remains that is amenable for detailed analysis of the behaviour of the Wireless LAN. A similar approach is followed with respect to the Internet, which can be represented as flow model comprising a huge network with countless small packages.'

'It is, of course, wonderful that the solutions derived from this research can also be used to solve health care problems. They are topical issues and much improvement can be realized using Operations Research techniques. Organisations often ask us questions unaware of the real underlying problem. You need to be able to communicate to determine the real questions, being unaware you may end up solving the wrong problems. You have to strip the problem down to its essence, which is something I like to do.

We work together with groups in the fields of Computer Science, Civil Engineering, Mechanical Engineering, and Production and Logistics. Students from other Bachelor programmes such as Mechanical Engineering, Civil Engineering, or Industrial Engineering and Management may fit in our Master programme. Graduates will have no difficulty finding jobs at a wide variety of organisations. OR experts are in great demand.'

Prof. dr. Richard Boucherie

2.6 STOCHASTIC SYSTEMS AND SIGNALS (SST)

Stochastic modeling is the key link of our research and teaching activities in systems & control (SC) and in financial engineering (FE). In system theory our focus is on control of dynamical systems where random disturbance is explicitly taken into account. In financial engineering the challenge is to price financial derivative products exactly, despite random fluctuations of the underlying asset prices.

Any realistic model of physical systems needs to take uncertainties into account. The path of an aircraft is always disturbed by wind gust, for example. Sometimes, systems are inherently random, as in the case of radars detecting unknown objects. Control or detection problems in these situations lead to two other related questions: how to filter the random signals and to identify the unknown system parameters based on

the measurements.

We are working closely with NLR (Dutch Aerospace laboratory) on short-term collision avoidance systems for multiple aircraft in the vicinity of an airport. This is part of a Europe wide effort to facilitate the expected growth of aircraft flights over Europe without increasing the risk of collision. With phased array radar the traditional radar detection has been transformed into detection of objects by a sensor network. Energy efficient sensor scheduling in such sensor networks is a major research problem at present. We work in this area with Thales Nederland in Hengelo and a host of other European (industrial) partners.

The application of stochastic system theory to finance is a relatively recent phenomenon. The new subject of financial engineering saw phenomenal growth from the 1990's. The issue here is not how to gamble in the financial market, but rather how to manage risks there. The instruments for this are called financial derivatives. The total market for derivatives outstanding is mind-boggling.

How to price the derivatives products and how to use them for managing risk need cutting-edge techniques from virtually all branches for applied mathematics, from partial differential equations and computational methods to (stochastic) operations research and optimization. But the central advance has been made by methods from applied probability and stochastic system theory. Applied mathematicians are the preferred choice of candidates for the employers in this area all over the world. Given the scarcity of experts in the field, jobs opportunities are overwhelming. They range from (investment) banks, insurance companies, pension funds to market makers and corporate finance professionals.

The same methodology and techniques developed for financial products are now being widely used in energy risk management. Electricity markets in Europe have been liberalized and futures on electricity prices are now traded as commodities in Amsterdam and elsewhere. We are working with Essent on a long-term basis on modeling electricity futures and related issues. Agreements expected to be reached in the future on the follow-up to the Kyoto protocol will give a big boost to research on carbon trading and new derivatives products. This will generate new challenges for our graduates.

FELab (Financial Engineering Laboratory) coordinates all teaching and research in Financial Engineering at our university. It is a partnership between the faculties EWI and MB. FELab forms a part of the SRO IE&ICT of the research institute CTIT and of the Industrial Engineering program of the newly created Graduate School of the University of Twente.

prof.dr. Arun Bagchi

2.7 STATISTICS AND THEORY OF PROBABILITY (SP) 'THE GREY AREA BETWEEN RIGHT AND WRONG'

Although sometimes deprecatingly called one of the 'three kinds of lies', statistics is one of the most commonly applied areas of mathematics. Prof. Wim Albers, for example, is investigating a number of compelling issues regarding quality control in industry and services.

'Besides working on applications, we also devote serious attention to solid mathematical statistics. The advantage is that, unlike the majority of those who merely apply statistics, mathematical statisticians also understand the underlying structure of systems. This enables us to apply statistics in a refined and mathematically responsible manner. Con-sequently, new methods are developed as well, and in this way we publish both on applications and on methodology.'

'If put to appropriate use, statistics can help individuals to make well-considered choices, particularly if data analysis offers no intrinsic process knowledge, for example in financial mathematics. Statistical analysis has been used for a long time to assess insurance risks. In addition, this mathematical technology is increasingly used to assess investment risks.' 'Statistical Process Control (SPC) or quality control is another field involving the application of statistical analysis. Industrial buyers often require that their suppliers' error margins do not exceed a few parts per million. This is especially true in the semiconductor industry where errors are very expensive. However, it is often difficult to establish a clear line between right and wrong for a given product. You are dealing with measurement errors and state-of-the-art products that often pass through dozens of manufacturing processes with different production margins.'

'It is all about calculating optimal yield. These methods have recently also been introduced in quality control systems in the services industry. In health care, for example, they are used to determine the accessibility of emergency services and the number of ambulances needed to guarantee predetermined arrival times.'

'What makes statistics so interesting is that it combines various disciplines. It is not pure mathematics as it involves striking a balance between application and mathematical theory. We learn from each application. It is our aim to discover patterns and to further abstract the problem. This results from time to time in publications in leading journals on mathematical statistics.'

Prof.dr. Wim Albers

SECTION C

Appendices

1 THE FACULTY OF EEMCS

The Faculty of Electrical Engineering, Mathematics and Computer Science (EEMCS) comprises three disciplines, each of which again has connections with other disciplines. Besides teaching, research is carried out in the faculties by our research groups/chairs. This research is entirely clustered in the university research institutes Institute for Nanotechnology (MESA+), the Centre for Telematics and Information Technology (CTIT) and MIRA.

1.1 Organization chart EEMCS
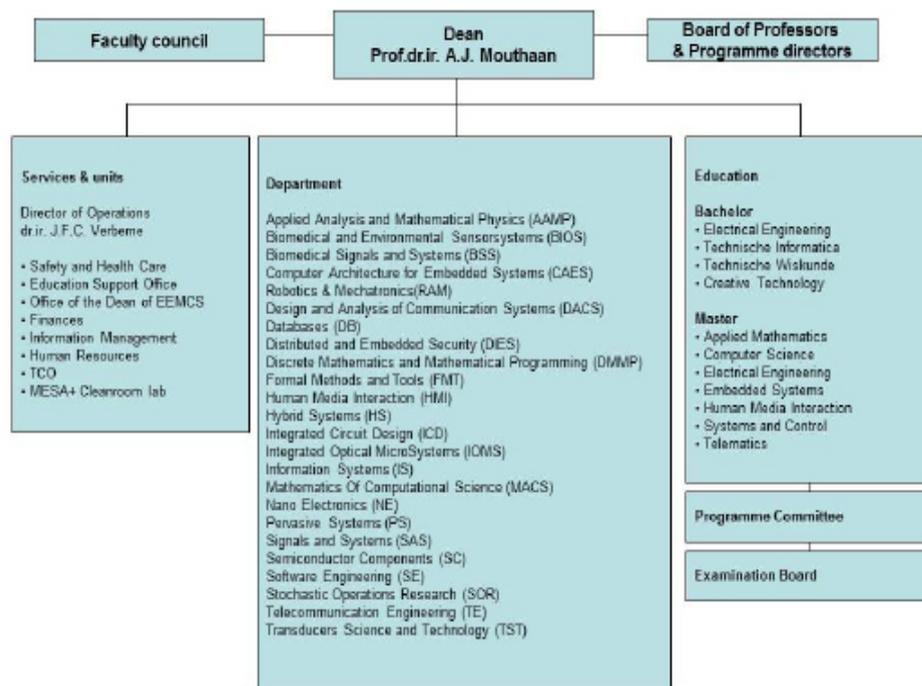
Dean

Dean of the faculty of EEMCS is prof.dr.ir. Ton Mouthaan. With him rests ultimate responsibility for all of the faculty's educational programmes.

Faculty Council EEMCS

The Faculty Council EEMCS is a representative advisory body of the faculty. The Council consists of eight students and eight staff members. The students are elected annually, the staff members serve on the Faculty Council for a period of two years. Nominations for the Council take place in April, the elections are held in June. The Council's term of office runs parallel to the academic year.

Depending on the subject at hand, the Faculty Council has advisory powers or the right of consent about the proposed decisions of the faculty dean. If he wants to take decisions about the outlines of personnel policy, regulations in the field of terms of employment and the occupational health and safety policy, the dean requires the consent of the Faculty Council beforehand. The dean also requires the Faculty Council's consent beforehand if he wants to take decisions on setting or modifying the faculty Education and Examination Regulation (OER), rules in the field of safety, health and well-being or policy on students' facilities.

For more information concerning the Faculty Council, please refer to:

www.utwente.nl/ewi/organisatie/bestuur/faculteitsraad (Dutch)

The Board of Professors

The Board of Professors consists of all professors and programme directors of the faculty.

1.2 Educational programmes

The faculty offers the following educational programmes:

• Bachelor's programmes:

Electrical Engineering (EE)

Computer Science (INF)

Applied Mathematics (TW)

Creative Technology (CreaTe)

• Master's programmes:

Applied Mathematics (AM)

Computer Science (CSC)

Electrical Engineering (EE)

Embedded Systems (EMSYS) (3-TU)

Human Media Interaction (HMI)

Systems and Control (SC) (3-TU)

Telematics (MTE)

Programme director

At the head of every educational programme is a programme director. He marks the outlines of the educational programme and is responsible for the content of the educational programme and its courses.

For EE (BSc and MSc) this is prof.dr. M.C. Elwenspoek (Miko)

For AM (MSc), TW (BSc) and SC this is dr. J.W. Polderman (Jan Willem)

For CSC (MSc), INF (BSc) and MTE this is dr.ir. R. Langerak (Rom)

For CreaTe en HMI this is dr. G.F. van der Hoeven (Gerrit)

For EMSYS this is prof.dr.ir. G.J.M. Smit (Gerard)

1.3   Services and units

The faculty has a number of EEMCS-wide service groups which are under the direction of the director of operations, dr.ir. J.F.C Verberne.

SAFETY AND HEALTH CARE EEMCS

Position	Name	Phone number
Coordinator	ing. S. Visser (Sjoerd)	+31 53 489 3153
	ir. F. Houweling (Frans)	+31 53 489 3583

OFFICE OF THE DEAN OF THE FACULTY OF EEMCS (BFD-EEMCS)

General e-mail address	BFD_ewi@ewi.utwente.nl	
Dean	prof.dr.ir. A.J. Mouthaan (Ton)	
Director of Operations	dr.ir. J.F.C Verberne (Jan)	

Faculty secretariat

Director of Operations and MT	E.C. Bosch-van der Heijden (Els)	+31 53 489 4602
Dean L	Tunc-Katalanc (Lena)	+31 53 489 4427

EDUCATION SUPPORT OFFICE EEMCS (BOB-EEMCS)

Position	Name	Phone number
Manager of Education	H.J. van Laar (Jolanda)	+31 53 489 4466
Internationalization	drs. J. Schut (Jan)	+31 53 489 4350
Educational support	drs. K.M.J. Slotman (Karin)	+31 53 489 5809

Coordinator New Educational Model

BSc Electrical Engineering	dr.ir. E.J. Faber (Erik)	+31 53 489 2041
BSc Computer Science	drs. J.A. Kamphuis (Jan)	+31 53 489 2771

Traineeship

Traineeship coordinator	dr. M.J. Korsten (Maarten)	+31 53 489 3887
Traineeship mediator	B. Jaarsma-Knol (Belinda)	+31 53 489 3887
Quality assurance	drs. J.H. Romkema (Hans)	+31 53 489 2774

Student advisers

MSc Computer Science, BSc/MSc Mathematics, MSc Telematics

	L. Spijker (Lilian)	+31 53 489 3493

Creative Technology, Human Media Interaction, Systems and Control, Embedded Systems and BSc/MSc Electrical Engineering

	T.H. de Kluijver (Thea)	+31 53 489 3697

BSc Computer Science and BSc Telematics

	S.B.A.M. Vonk MSc (Sharon)	+31 53 489 5645

Secretariat

Student advisers, Internationalization	R. Assink (Remke)	+31 53 489 3426
Quality assurance	A. de Bruin-van Willigen (Annemieke)	+31 53 489 3725
Programme directors	K. Veldhuis (Karin)	+31 53 489 5450
	S. Biharie (Satie)	+31 53 489 2751

COMMUNICATIONS

Communications is a shared service directorate within the UT. The following contacts apply for the faculty of EEMCS:

Position	Name	Phone number
Communications staff	D. Dalenoord (Diana)	+31 53 489 3450

PREMISES MANAGEMENT

Position	Name	Phone number
Premises Manager	ir. M.J.B. ten Bulte (Michel)	+31 54 489 2800
Service desk	Servicedesk.carre@fb.utwente.nl	+31 54 489 2299

LIBRARY & ARCHIVE

Library & Archive is a service within the University Library of the University of Twente.

Position	Name	Phone number
Information Specialist		
Computer Science, Applied Mathematics	Mrs drs. P. de Willigen (Petri)	+31 53 489 2085
Electrical Engineering	ir. W.C. Oosterling (Wim)	+31 53 489 2079

FACILITY SERVICE CENTRE

The Facility Service Centre is a shared service centre that offers its services within and for the various faculties, including EEMCS.

Position	Name	Phone number
Service desk	Servicedesk.carre@fb.utwente.nl	+31 54 489 2299

Building Manager

Citadel	N.C.M. Heijnekamp (Nancy)	+31 53 489 5768
Zilverling, Carré	T.B.M. Busscher	+31 53 489 6284
Account Manager EWI	N. Kloek (Nico)	+31 53 489 6251

ICT SERVICE CENTRE (ICTS)

ICTS is a shared service centre within the University of Twente. The following contacts apply for the faculty of EEMCS.

Position	Name	Phone number
Account Manager EEMCS	ing. A.B. Tibben (Tonnie)	+31 53 489 3724
ICTS Service desk	icts.servicedesk@utwente.nl	+31 53 489 5577

STUDENT & EDUCATION SERVICE CENTRE

The Student & Education Service Centre (S&O) performs tasks on a central level as well as within the various faculties. The Student & Education Administration (S&OA) EEMCS deals with all sorts of educational affairs and is part of this service centre. The Student & Education Administration is also known as the Bureau Onderwijszaken (BOZ, Office for Educational Affairs).

Position	Name	Phone number
Team leader BOZ EEMCS	M.H. Huiskes-Borghuis (Miranda)	+31 53 489 4605
OSIRIS/Blackboard key user	D. Muller (Diane)	+31 53 489 2681

Educational support

Educational support is provided by the university Student & Education Service Centre (S&O) and the Education Support Office (BOB) of the faculty. The education administration is part of the Bureau Onderwijszaken (BOZ/S&O). See also section 4.1. EEMCS-wide coordination in the fields of Internationalization, Quality assurance, Traineeship and Study advice takes place from the BOB.

1.4 Facilities

PC-rooms

For practical courses the faculty of EEMCS has a number of PC-rooms available. The W-zaal (West-room) situated in Zilverling/Hal A is mainly scheduled for Electrical Engineering practicals. Situated in Zilverling/Hal A as well is a general practical space, the flex office of Smart XP. Furthermore, there is a general computer room on the fourth floor of the Zilverling building (ZI 4054) 36 PCs. During lecture hours a room assistant is present in room4054. At night this room is open until 20.30h. After 18.00h, you can obtain entrance via the night porter at the main entrance of the Zilverling building.

Please note that there are staff rooms situated near the course rooms in the Zilverling. So please keep quiet in the building corridors, limit talking and do not use your phone, butgo to the stairwell or the Educafe instead. Eating is prohibited in the PC-rooms; drinking is only allowedwhen using lockable bottles.

Year room

For first-year Bachelor students of the Mathematics, Electrical Engineering and Creative Technology programmes, year rooms are used for most classes will take place there. Instead of moving groups of students between lecture rooms, teachers will come to the one room dedicated to one of the programmes. Outside lecture hours this room can be used for self-study or as a project space.

BSc Mathematics	Citadel T100
BSc Electrical Engineering	Oosthorst 210
BSc Creative Technology 1st year	Smart XP
BSc Creative Technology 2nd year	Zilverling 3042
BSc Creative Technology 3rd year	Zilverling 2042

Smart XP Lab

This new multifunctional area in the Zilverling building is structurally used for teaching purposes towards the CreaTe programme. The lab is a true research playground and offers ample opportunity for testing and experimenting. This lab is, as it were, a meeting point where every possible research set-up is imaginable.

Educafe

Next to the (main) entrance of the Zilverling building, you will find the Educafe: a space where you can study, work in groups and relax with your fellow students. There are computer workspaces and you can grab a drink or snack from the vending machines. In short: this is an ideal environment to work together on projects. In the Educafe there are two rooms for get-togethers where students frequently sit around. On the first floor, three EEMCS student associations are situated: Scintilla (Electrical Engineering), Abacus (Applied Mathematics) and Inter-Actief (Computer Science). The student association for CreaTe, Proto, has its room in Zilverling/ Hal A, above the Smart XP

The Educafe also hosts two shops: IAPC and Stores. IAPC is a non-profit shop where you can turn to when you have questions about or want information on computers. Besides, you can buy laptops and all sorts of computer parts there for reasonable prices. 'Stores' sells components (such as resistors and capacitors) and office supplies. Furthermore, IAPC as well as Stores sells study books. Both shops are run entirely by volunteers and they are open during weekday lunch breaks for most of the year.

2 THE ORGANIZATION OF EDUCATION

2.1 Students' Charter

As every institute for higher education in the Netherlands, the University of Twente also holds a Students' Charter. The Students' Charter is legally based in art. 7.59 of the Dutch Higher Education and Research Act (WHW). The Dutch text of the Students' Charter is law-making. This means that in case of problems or conflicts you can appeal to the content of the Dutch text of the Students' Charter (or Studentenstatuut). The Students' Charter contains a programme-specific section (the OSS) and an institute-specific section. The institute-specific section of the Charter is at all times available in its most up-to-date form on the website www.utwente.nl/so/studentenbegeleiding/en/regulations/charter.

If you would like to have a printed version of the Charter, it is available on request from the Red Desk: the information desk of the Student Counselling Service.

A copy of the programme-specific section of the Charter (OSS), which contains the Education and Examination Regulation (OER), can be collected from Bureau Onderwijszaken (BOZ). The programme-specific section contains at least:

- a description of the structure of the programme and the supporting facilities the institute offers to the students, including in any case (for definitions, please refer to the programme-specific section in question of the Charter):

- information about the set-up, organization and realization of education,

- the student facilities, and

- the facilities concerning tutoring,

•

the Education and Examination Regulation (OER)

•   a description of procedures aimed at protecting the rights of students, which apply to the programme, in addition to the procedures that are established by the institutional administration.

www.utwente.nl/ewi/en/education/oer

2.2   Student Enrolment/Re-enrolment

Each academic year you are required to re-enrol at the University of Twente using Studielink. This re-enrolment is grafted on to the regulations in the Dutch Higher Education and Research Act (WHW) and it must be completed before 1 September. As soon as your request for re-enrolment via Studielink is received by the Central Student Administration (CSA), it will be verified whether you satisfy the conditions for enrolment. If you qualify for enrolment, your enrolment will be completed as soon as all enrolment documents have been submitted and the payment of your tuition fees is processed.

To enrol or reenrolbefore 1 September, you must complete all enrolment formalities before 1 August.

When your enrolment is complete, as proof of enrolment you will receive your student card and two declarations of enrolment. The declaration contains, among other things, the programme(s) and the period for which you are enrolled.

On the university level there are various student service centres, which are united in the Student & Education Service Centre (S&O). The student desk accommodates the service centres. The main services are mentioned below.

2.2.1   Student and Education (S&O)

Student Services

Student Services offers various support services: you can go there to have your digital picture taken for your student card, to register, enrol or de-enrol. Student Services is situated in the Vrijhof building. See also:

www.utwente.nl/so/studentservices/en/.

Student Counselling Service

The desk of the Student Counselling Service (the "Rode Balie") is responsible for individual care and support of UT students at a coordinating level (besides the care educational programmes take for their "own" students). This includes for example a student psychologist, various courses ("self management", graduating, job application) and the student counsellor.

Student psychologist

You can get help from the student psychologist when you need to talk to someone, for instance when you experience personal problems such as problems in your relation with your parents, friends or fellow students. You do not need a referral: you can make an appointment yourself. The student psychology service aims at having the first session within a week after the student contacted them.

Student counsellor

The student counsellor offers help when you have questions about, for instance, student grants, UT financial support, switching disciplines, problems involved with switching from a school for Higher Vocational Education to University, personal problems, appeal procedures, studying abroad, studying with a disability, and entrance examination (colloquium doctum). In order to make an appointment you need to telephone the secretariat. You have to take the initiative yourself to make an appointment with the student counsellor. At certain times the student counsellor does consultations without appointment, for which you do not have to make an appointment in advance.

The "Rode Balie" is situated in the Bastille building. For more information, go to:

www.utwente.nl/so/studentenbegeleiding/en.

Complaints Desk

As from 1 April 2011 the UT arranged for a so-called Complaints Desk. Any student or external student, including prospective and former students, can turn to the Complaints Desk with a formal complaint, a formal appeal, or a formal objection. The Complaints Desk is situated with Student Services on the second floor of the Vrijhof building.

You will find more information about the Counter and the complaints procedures on:

www.utwente.nl/so/studentservices/en/complaints_desk

2.3   Communication and Information

When you want to take up a study at the University of Twente, from the very start you will be faced with various means of communication the university, the faculty and your programme use to communicate with you. As soon as your preliminary enrolment at the University of Twente is received, you will be provided with an e-mail account, user name and password. You will also be provided with some writing space of your own,

where you can save your documents and where you might put your own home page. The Internet is by far the most important means of communication of the programme and the university.

E-mail

Whenever the programme or a particular lecturer wants to communicate quickly with a particular student or a small group of students, this will be done by e-mail. The Student & Education Service Centre (S&O) also uses e-mail to communicate with large groups of students. This occurs, for instance, when a lecture is suddenly cancelled or when an examination has to be rescheduled. In those situations, S&O is unable to contact the students in time through the usual channel of communication of the educational programmes, which is the Education Announcement. S&O also uses e-mail to announce, for example, information sessions about study-related matters.

UT students in general have e-mail addresses such as: <student name>@student.utwente.nl. In this address <student name> is replaced with a person's initials and surname. Exceptions do occur, especially when a number of UT students have identical initials and surnames.

You can find e-mail addresses of UT students and staff on the UT website. Go to http://my.utwente.nl/.

MyUniversity

MyUniversity, the UT student portal, gives access to all UT data systems (OSIRIS, Blackboard). You can log on at http://my.utwente.nl/.

Besides, the portal gives access to the timetables for teaching and to some other services.

Education Announcements

Every Education Announcement (Onderwijsmededeling) is spread through the Internet. The same applies for announcements concerning graduation colloquia and presentations of Bachelor's and Master's assignments. You can read them via the MyUniversity portal.

The Education Announcement is the programme's main means of communication to communicate with all of its students. It is important to check if there are any changes in the timetable every day, in order to be informed as much as possible and to prevent sitting in the wrong lecture-room at the wrong time.

Timetable for teaching activities

The portal MyUniversity gives access to the timetables for teaching activities. Changes will be immediately incorporated in the timetables. On the first page of your timetable you will find an overview of the latest changes.

OSIRIS (Student information system)

OSIRIS is aself-service student information system at the UT. Via MyUniversity you can log in on OSIRIS using an 's' plus your student number and the corresponding password. You can find a user manual and further information on www.utwente.nl/onderwijssystemen/en.

If you have any questions, you can turn to Student Services (Vrijhof building).

studentservices@utwente.nl, phone number +31 53 489 2124.

Blackboard

Blackboard is the digital learning environment of the UT. It offers all the information you need to follow a course, such as the timetable, the contents of the lectures and additional information on the course material and the examination or assignment. Within a Blackboard site you can also communicate with fellow students and lecturers or work together on assignments.

Blackboard is a lecturer's main means of communication to communicate with his or her students about a course. On this site you may also find important announcements and news items on the course.

You need to sign up for each course via Blackboard and OSIRIS. If you have any questions on Blackboard or OSIRIS, within the faculty you can turn to S&O, Diane Muller, Citadel H208, phone +31 53 489 2681.

For a Blackboard manual, go to blackboard.utwente.nl. The Support tab holds a quick reference and a manual.

ICT Account

To get access to the courses, you will need an account. After your registration at the CSA, the ICTS will usually provide you with a user name and password, the so-called ICT account, by letter within 10 workdays.

If you were not provided with an ICT account or if you lost your password, please report this at the ICTS servicedesk, located at Horstring W122 (icts.servicedesk@utwente.nl, phone number +31 53 489 5577) and keep your student card at hand.

Programme websites

For the EEMCS Bachelor's programmes, educational information is available on the following websites:

Creative Technology	www.utwente.nl/create
Electrical Engineering	www.utwente.nl/el
Computer Science	www.utwente.nl/inf
Applied Mathematics	www.utwente.nl/tw

For the Master's programmes:

Applied Mathematics	www.utwente.nl/am
Computer Science	www.utwente.nl/csc
Electrical Engineering	www.utwente.nl/ee
Embedded Systems	www.utwente.nl/emsys
Human Media Interaction	www.utwente.nl/hmi
Systems and Control	www.utwente.nl/sc Telematics www.utwente.nl/mte

You can also find an overview of all programme guides, teaching regulations, etc. on www.utwente.nl/ewi/en/education.

2.4   Student card

The student card issued by the University of Twente is valid proof of identity within the UT and it is also a proof of enrolment. You are required to show the student card at request when making use of university facilities such as attending lectures, taking examinations, or visiting libraries. You will receive your student card and two declarations of enrolment through the post as soon as you are registered. So please see to it that the Central Student Administration (CSA) has your correct address.

Uses of the student card:

□ Student card

The card is a valid proof of enrolment for the academic year 2012-2013.

□ Library pass
The student card barcode enables the card to serve as a library pass.

□ Xtra card

If you want to make use of the sports and cultural facilities in Enschede, the card serves as Xtra card as well. See www.xtra-card.nl/en .

Declaration of enrolment

With a declaration of enrolment you can prove your enrolment (for instance to get a student grant or at your insurance company). The declaration contains, among other things, the programme(s) and the period for which you are enrolled.

Theft/loss

In case of theft or loss of the card, you can apply for a new student card on payment of EUR 5.- at the Student Services desk in the Vrijhof building.

No student card yet?

If your enrolment has not yet been fully completed, no student card will be produced. In addition to your enrolment the CSA requires a digital photograph. You can upload a recent passport photograph in Osiris Student.

2.5   Year's schedules

The year is divided into two semesters, each of which is divided into two quarters. Most courses will take one quarter and will be completed in the same quarter, mostly through a written examination. In every quarter 15 ECTS-credits are scheduled. The quarters run as follows:

• Quarter 1 from week 36 (3 September 2012) until week 45 (9 November 2012)

• Quarter 2 from week 46 (12 November 2012) until week 05 (1 February 2013)

• Quarter 3 from week 06 (4 February 2013) until week 16 (19 April 2013)

• Quarter 4 from week 17 (22 April 2013) until week 26 (28 June 2013)

Resits will take place in weeks 27 (1-5 July) and 30 (22-26 July)

For the exact schedule of courses see the timetables on the website http://myutwente.nl/ut/.

s.v.p. jaarroosters UT tussenvoegen zie

http://www.utwente.nl/so/roosterwerkgroep/jaarcirkels/jaarcirkel_2011-2012.pdf (dutch)

For a brief summary in English: http://www.utwente.nl/so/roosterwerkgroep/en/

2.6   Lectures

The lecture hours on a 3TU level are identical at all three of the institutes. This facilitates the exchange of education between the 3TU institutes by means of real time video conferencing.

The lecture hours fit in very well with a very simple and straightforward model: all lecture hours start at a quarter to the hour and end at the half hour.

There are fifteen-minute breaks between lecture hours, lunch and dinner breaks last 75 minutes. Starting times of written examinations fit in with this schedule. The longer breaks between the morning and afternoon lectures and the afternoon and evening lectures respectively, are included in a consecutive numeration.

1st period:	08:45 - 09:30
2nd period:	09:45 - 10:30
3rd period:	10:45 - 11:30
4th period:	11:45 - 12:30
5th period = lunch break:	12:45 - 13:30
6th period:	13:45 - 14:30
7th period:	14:45 - 15:30
8th period:	15:45 - 16:30
9th period:	16:45 - 17:30

2.7 Taking courses

You need to sign up for each course via Blackboard and OSIRIS. To get access to the courses you require an account. The ICTS will provide you with a user name and password.
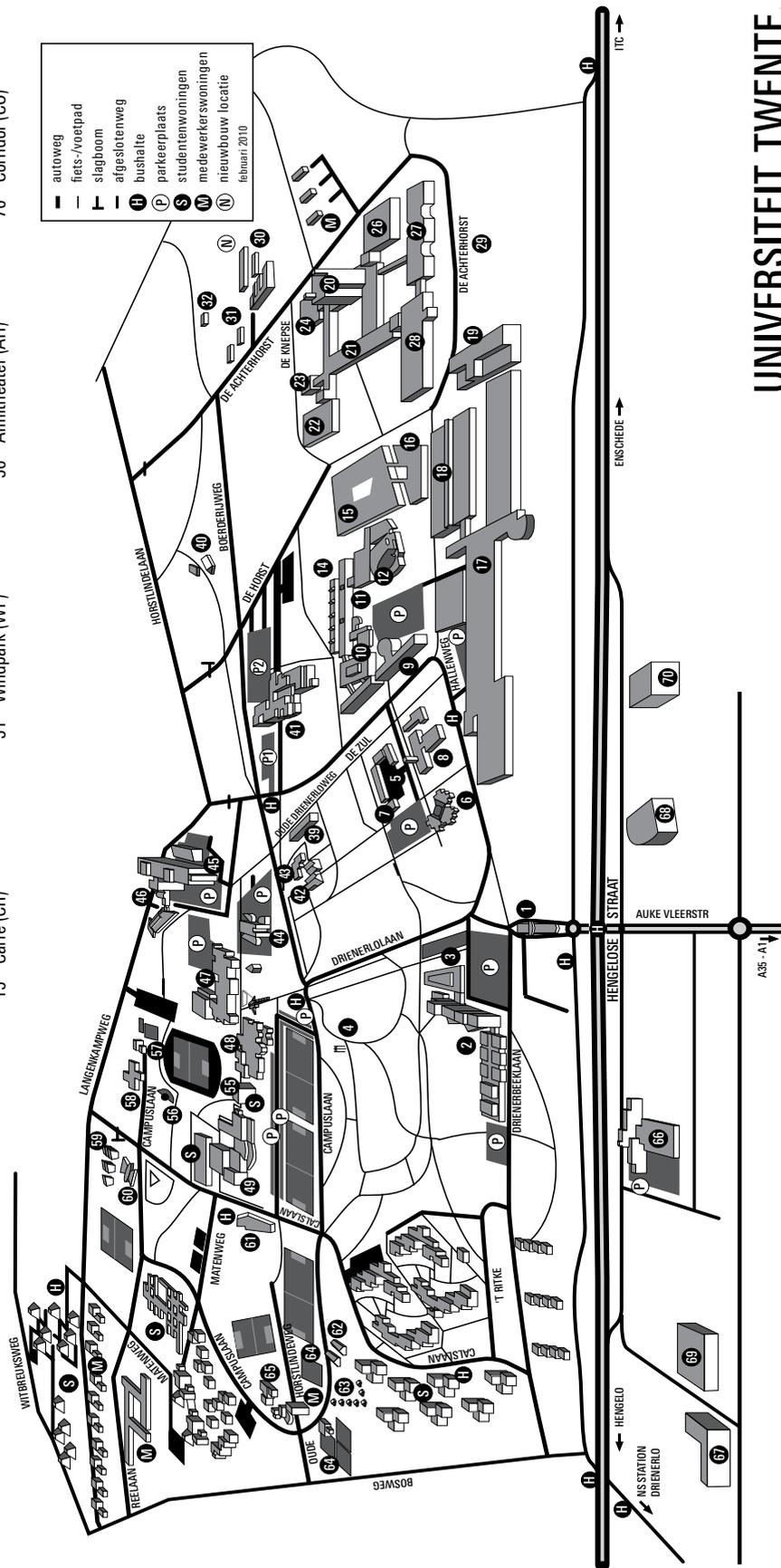
2.8 Knowing your way on campus

All of the faculty of EEMCS teaching takes place in rooms situated in buildings which are spread all over campus. In the time tables the lecture rooms are indicated using a code in which the first two letters indicate the building where the room is situated. The list below contains the most frequently occurring abbreviations of buildings. The computer practicals generally take place in one of the Zilverling rooms.

CI	Citadel
CR	Carré
CU	Cubicus
HB	Hal B (main entrance Zilverling, Carré and Waaier; location servicedesk Carré)
HO	Hogekamp
HR	Horstring
HT	Horsttoren

UNIVERSITEIT TWENTE.

Student & Onderwijs Service Centrum
Student & Onderwijs Administratie

Jaarcirkel 2011-2012, definitieve versie, eerste en tweede semester

1e semester

weeknummer	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	1	2	3	4	5	
weektype	C	C	C	C	C	C	C	C	T	T	C	C	C	C	C	C	V	V	C	C	T	T	
aantal weken	1-01	1-02	1-03	1-04	1-05	1-06	1-07	1-08	1-09	1-10	2-01	2-02	2-03	2-04	2-05	2-06			2-07	2-08	2-09	2-10	
maandag	Open. acad. jaar	12	19	OIT	3	10	17	24	31	7	14	21	28	OIT	12	19	2e Kerst-dag	2	9	16	23	30	MA
dinsdag	6	13	20	27	4	11	SIT	25	1	8	15	22	29	6	13	20	Verpl. ADV	3	SIT	17	24	31	DI
woensdag	7	14	21	28	5	12	19	26	2	9	16	M-voorl.	30	7	14	21	Verpl. ADV	4	11	18	25	1	WO
donderdag	8	15	22	29	6	13	20	27	3	10	Voorl. Duits	24	1	8	15	22	Verpl. ADV	5	12	19	26	2	DO
vrijdag	9	16	23	30	Gem. P-uitr	14	21	28	4	11	B-voorl.	Diës-viering	2	9	16	23	Verpl. ADV	6	13	20	27	3	VR
zaterdag	10/09	17/09	24/09	01/10	08/10	15/10	22/10	29/10	05/11	12/11	19/11	26/11	03/12	10/12	17/12	24/12	31/12	07/01	14/01	21/01	28/01	04/02	
zondag	11/09	18/09	25/09	02/10	09/10	16/10	23/10	30/10	06/11	13/11	20/11	27/11	04/12	11/12	18/12	25/12	01/01	08/01	15/01	22/01	29/01	05/02	

2e semester

weeknummer	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
weektype	C	C	C	V	C	C	C	C	C	T	T	C	C	C	C	C	C	C	C	F	T	T	
aantal weken	3-01	3-02	3-03		3-04	3-05	3-06	3-07	3-08	3-09	3-10	4-01	4-02	4-03	4-04	4-05	4-06	4-07	4-08		4-09	4-10	
maandag	6	13	20	27	OIT	12	19	26	2	2e Paas-dag	16	23	Kon. dag	7	14	OIT	2e Pinkst. dag	4	11	18	25	OIT	MA
dinsdag	7	14	21	28	6	13	20	SIT	M-voorl.	10	17	24	1	8	15	22	29	5	SIT	19	26	3	DI
woensdag	8	15	22	29	7	14	21	28	M-voorl.	11	18	25	2	9	16	23	30	6	13	20	27	4	WO
donderdag	9	16	23	1	8	15	22	Voorl. Duits	5	12	19	Minor-voorl. markt	3	Hemel-vaarts-dag	Hemel-vaarts-dag	24	31	7	14	21	28	5	DO
vrijdag	10	17	24	2	9	16	23	B-voorl.	Goede Vrijdag	13	20	27	4	11	Verpl. ADV	25	1	8	15	22	29	6	VR
zaterdag	11/02	18/02	25/02	03/03	10/03	17/03	24/03	31/03	07/04	14/04	21/04	28/04	05/05	12/05	19/05	26/05	02/06	09/06	16/06	23/06	30/06	07/07	
zondag	12/02	19/02	26/02	04/03	11/03	18/03	25/03	01/04	08/04	15/04	22/04	29/04	06/05	13/05	20/05	27/05	03/06	10/06	17/06	24/06	01/07	08/07	

PLATTEGROND UNIVERSITEIT TWENTE

1 Charlie (CH)
2 Spiegel (SP)
3 Vleugel (VL)
4 Carillon (CN)
5 Garage (GA)
6 Paviljoen (PA)
7 Seinhuis (SH)
8 Hogedrukkab (HD)
9 Citadel (CI)
10 Ravelijn (RA)
11 Zilverling (ZI)
12 Waaier (WA)
14 Teehuis (TH)
15 Carré (CR)

16 Nanolab (NA)
17 Langezijds (LA)
18 ArtEZ (AR)
19 Temp (TE)
20 Horsttoren (HT)
21 Horstring (HR)
22 Westhorst (WH)
23 Kleinhorst (KH)
24 Noordhorst (NH)
26 Oosthorst (OH)
27 Meander (ME)
28 Zuidhorst (ZH)
30 Centraal afvalstoffendepot (AF)
31 Windpark (WP)

32 Biomagnetisch centrum (BI)
39 Chalet (CT)
40 Erve Holzik (ER)
41 Cubicus (CU)
42 Faculty Club (FC)
43 Schuur (SR)
44 Drienerburght (DR)
45 Hogekamp (HO)
46 Cleanrooms (CC)
47 Vrijhof (VR)
48 Bastille (BA)
49 Sportcentrum (SC)
55 Winkelcentrum (WC)
56 Amfitheater (AH)

57 Zwembad (ZW)
58 Sleutel (SL)
59 Mondriaan (MO)
60 Vlinder (VL)
61 Santar (SA)
62 Boerderij Bosch (BB)
63 Blokhutten (BL)
64 Tennispark (TP)
65 Logica (LO)
66 BTC
67 Capitool (CA)
68 KPMG-gebouw (KP)
69 Institutenweg (IIN)
70 Corridor (CO)

autoweg
fiets-/voetpad
slagboom
afgeslotenweg
bushalte
parkeerplaats
studentenwoningen
medewerkerswoningen
nieuwbouw locatie

februari 2010

UNIVERSITEIT TWENTE.

LA   Langezijds

RA   Ravelijn

SC   Sportcentrum

SP   Spiegel

VR   Vrijhof

WA   Waaier

ZI   Zilverling

For a map of the University of Twente see:

http://www.utwente.nl/media/28498/plan-campusmap-en.pdf

2.9   Study material

Textbooks, lecture notes, readers or syllabuses are required for virtually every course. For those you can turn to the student association and the UnionShop.

The lecture notes, readers and syllabuses will be sold from the beginning of every semester at the UnionShop. You can check the website to see if they are in stock: www.studentunion.utwente.nl/about-su/buildings/unionshop.html.

2.10   PC-privé scheme for UT students and PC, laptop and printer purchase

The UT offers the possibility of an interest-free loan for the acquisition of the notebook provided by the NSC. The exact arrangements and conditions for the loan can be found in the students statutes. With the interest-free loan, the University of Twente will advance the funds necessary for your Notebook, which you will have to pay back to the University within 24 months. The maximum amount that you can borrow from the UT is €1,000 euros..

Principal requirement:

Once in the Bachelor's phase and once in the Master's phase, provided the student in question is 60 ECTS-credits or more away from the degree in the respective phase.

Exceptions:

1. When attending a one-year Master's course, the student may sign up for the scheme no later than one month after the beginning of the programme;

2. Students enrolled in a Bachelor's programme who take courses in the Bachelor's phase as well as in the Master's phase and who still have to attain at least 60 ECTS-credits for both phases taken together are also

entitled to take part in the scheme. Taking part in the scheme is then regarded as taking part during the Master's phase.

Note: this also includes students entering a programme via an alternative route who are attending a so-called 'bridging programme'.

As a UT student you can purchase a high-quality notebook at the Notebook Service Centre at a highly competitive price along the the service guarantee that after handing the notebook in at the service desk you will obtain a working model within one hour Obviously the notebook will also fulfil the requirements set by the universities bachelor's programmes.The Notebook Service Centre also provides general UT software (such as Maple, Virusscanner, SPSS) through downloads. Special software may be available via your faculty.

For more information on the PC-privé scheme, refer to:

www.utwente.nl/so/studentenbegeleiding/en/regulations/notebook/

3   UT REGULATIONS

3.1   Studiefinanciering (Dutch student grant)

The contribution of the Dutch government towards the cost of education is called studiefinanciering. It consists of either a conditional grant plus an additional loan (the so-called blended studiefinanciering), or just a loan. The grant of DUO (Dienst Uitvoering Onderwijs, the government institution responsible for the Dutch student grants) allows students to receive part or all of their training outside the Netherlands. The entitlement to studiefinanciering depends on your first year of enrolment. In any case, you have to be enrolled as a student and you should not be over 30.

If you have any questions about the UT regulations below, you can also consult your study adviser.

3.3   Regulation graduation support

Students at the UT with certain special circumstances can make use of the Regulation graduation support. Students can appeal to this regulation when they have run into a delay due to recognized special circumstances during a period of blended studiefinanciering. The blended studiefinanciering concerns the period for which the studiefinanciering can partially be converted to a gift; in other words: the period in which the student is entitled to the basisbeurs (basic grant). To apply for graduation support you can contact the student counsellor in the Bastille building.

www.utwente.nl/so/studentenbegeleiding/en/regulations/graduationsupport

3.4   Top-level sport

Combining university-level studies and top-level sport can be problematic for many students. It generally proves impossible to postpone either academic studies or a career in sport until later; both activities require the practitioner to achieve results within a relatively short period of time. The UT is aware of the problems involved and has developed a policy covering the practice of top-level sport.

See also: www.utwente.nl/so/studentenbegeleiding/en/regulations/topsports/

3.5   Regulation encouragement student activism

Within the framework of encouragement of student activism there is a special regulation for active students. This involves the individual readjustment of educational obligations for active students, in order for them to have more flexibility in their studies and so that they will run into less delay because of their activism. If you want to know if you qualify for this regulation or if you want more information, go to: www.utwente.nl/so/studentenbegeleiding/en/regulations/graduationsupport

www.utwente.nl/so/studentenbegeleiding/en/regulations/ravis

3.6   Studying with a disability

Being disabled, following an educational programme is not always easy. However, the UT makes a serious effort to enable the disabled to study. Physically or sensory disabled students or dyslexic students are given the opportunity to take examinations in a way that is tailored to the requirements of their personal disabilities as much as possible. Students who fall under this regulation have been brought to the attention of S&O/BOZ and the EEMCS lecturers concerned through a letter of the study advisor.

www.utwente.nl/so/studentenbegeleiding/en/counselling/firstyear/introductionprogramme/

www.utwente.nl/so/studentenbegeleiding/en/counselling/firstyear/register

http://www.utwente.nl/so/studentenbegeleiding/en/counselling/firstyear/counselling/

In general, being disabled, it may be wise to talk to the student counsellors and the study advisor of the faculty before the start of your studies. This may prevent any disappointments.

4 UT FACILITIES

4.1 Office for Educational Affairs EEMCS

The Office for Educational Affairs (BOZ, Bureau Onderwijszaken) of the faculty of EEMCS is part of the Student & Education Service Centre (S&O) and assists the faculty in registering study results, supervising the (individual) students' study programmes, organizing everything surrounding final assessment, making timetables, organizing examinations and organizing administrative systems.

BOZ is situated on the second floor of the Citadel, rooms H205-209. You can turn to them with most of your practical questions. They are reachable by telephone number +31 53 489 3794 or by e-mail boz@ewi.utwente.nl.

In addition to this, you can turn to Student Services on the first floor in the Vrijhof building with any questions concerning education.

4.2 UnionShop

The UnionShop is situated on the ground floor in the Bastille building. The UnionShop sells lecture notes, readers and syllabuses. It also runs a copy service. In the self-service section not only copies can be made, but also reports can be bound, flyers cut, etc.

4.3 Notebook Service Centre

Nowadays, a notebook is virtually indispensable to any student at the University of Twente. You require your notebook to communicate with others, to collect information, to make calculations and drawings, to perform simulations and even to take examinations.

Are you planning to buy a notebook in July or August? Every year in the summer, the ICTS Notebook Service Centre of the UT selects notebooks which most assuredly will meet the requirements of your educational programme! www.utwente.nl/icts/en/nsc

On the Notebook Service Centre website various software packages are available for download, including Maple, Matlab, Solidworks, SPSS, VanDale etc. For more information, go to: www.utwente.nl/icts/en/nsc/

SERVICE DESK

All students and university staff members can turn to the ICTS Service desk if they have problems or questions in the field of ICT. The ICTS Service desk is open from 08.30 until 17.00h and is reachable by telephone number +31 53 489 5577.

The service desk is situated in Horstring W122 (next to the Notebook Service Centre). With 'general' questions on ICTS you can turn to icts.servicedesk@utwente.nl. For more information, go to: www.utwente.nl/icts/en/servicedesk.

4.4 Library/information specialist EEMCS

The central library of the University of Twente, situated in the Vrijhof building, contains books and journals on a number of disciplines. In addition, it contains study facilities such as study places in the reading rooms, quiet study places, working areas and PC work areas. The University Library catalogue, which includes the faculty libraries and the central library, is available online (www.utwente.nl/ub/en). Here you can also consult the catalogues of all Dutch University Libraries.

You need a student card if you want to lend publications or if you want to make use of the study facilities, for the student card serves as a library pass. Further information on lending or ordering publications is available at the desk of the library. The University of Twente is working on the accessibility of scientific journals. More and more journals can be consulted through the Internet.

The opening hours of the central library are from 08.30 until 22.00h on workdays, and from9 until 16.30h on Weekends(for study purposes only). The information desk is open from Monday to Friday from 08.30 until 17.00h. You will find more information on www.utwente.nl/ub/en.

The University of Twente has a team of information specialists who offer support in the purchase of books, provide information on how to use the (digital) library and how to find scientific information on research and education for both staff and students.

For EEMCS, the information specialists are:

- Mrs drs. P. (Petri) de Willigen, Citadel building H203, phone +31 53 489 2085

- ir. W. (Wim) Oosterling, Carré building, phone + 31 53 489 2079

4.5   Student restaurant

In the Waaier building, the student restaurant of the UT is situated. The restaurant is based on the so-called free-flow system, which means that at various free-standing points of distribution a broad assortment is offered. Here you can get a hot day's menu, the Dagmenu. You can also choose to have the more luxurious menu, or select from a broad assortment of sandwiches, rolls, snacks, desserts and hot and cold drinks.

5   STUDENT ACTIVISM AND STUDY ASSOCIATIONS

Organizing various activities requires qualities and skills which you may benefit from for the rest of your life. So being active in an association (being on a committee or a board) will always beneficial to your CV. In the professional field, surely students will be watched for who did more than just study.

Being active also helps you getting introduced to people you might never meet otherwise. Moreover, board members often have a specific position, such as chairman, secretary or treasurer. Positions like this will teach you how to draw up an agenda, to chair meetings, to take minutes or, for instance, to draw up an estimate.

Every educational programme has its study association. They all organize all sorts of study-related activities, such as lectures, excursions and conferences. But also recreational activities are laid on, such as get-toghethers and parties. In addition, the student association for instance takes care of the book sale.

The study association for Electrical Engineering is Scintilla, for Creative Technology this is Proto, Abacus is the study association for Applied Mathematics and Inter-Actief for Computer Science.

Student participation and other committees

Within the faculty of EEMCS of your study programme you may become a member of various committees, such as the Faculty Council, Programme Committee or the Programme Quality Committee.

COLOFON