UNIVERSITY OF TWENTE.

Faculty of Electrical Engineering, Mathematics and Computer Science

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

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

With pleasure we present you this booklet with the descriptions of the master’s programmes Computer Science, Telematics and Human Media Interaction of the University of Twente.

Most readers, we assume, will be familiar with the Computer Science field. You know about the Computer Science fundamentals. You are aware of the impact Computer Science has and has had on our society and our everyday life. In fact, you probably understand more of this impact than the average layman.

Master’s programmes are specialized. They are not about basic knowledge and skills in a broad area. They are about pushing boundaries; to gain (often relatively small) new insights, generally only in a small area. But each change contributes to the strength of the Computer Science field.

Pushing a boundary is hard work. You have to understand in detail what is going on at the edge of your field. There is a great variety of things that can slow down progress. Physics may seem to work against you, complexity and lack of proper analysis tools may be a hindrance, and of course all sorts of human factors can be a challenge. You have to be aware of methods and techniques that are available to solve the problems you encounter. And sometimes you simply have to get lucky: look at the obstacle that is in your way from the right perspective, and then you realize it is not an obstacle at all. There is a skill to develop here, one of the strong points of the creative expert is that he gets lucky more often than others.

In the course descriptions in this book you will not find the phrase “pushing boundaries”. But it is an important characteristic of taking a master’s degree. In a 120 EC programme, 2 years of full-time study, you learn what it is to push boundaries. And even if it does not look like it, that is what this book is about.

Dr. ir. Rom Langerak
Programme director Computer Science and Telematics

Dr. Gerrit F. van der Hoeven
Programme director Human Media Interaction
Department of Computer Science

Since 2002 Computer Science has been a department within the Faculty of Electrical Engineering, Mathematics and Computer Science (EEMCS) of the University of Twente. The department is organized into chairs, each covering a distinguishing part of the broad field of computer science. In addition to being involved in scientific research, the Computer Science Chairs are also responsible for the curriculum of the Bachelor of Science programme Computer Science and the Master of Science programmes Computer Science, Human Media Interaction and Telematics.

In this guide you can find information about the following master’s programmes:

1. Master of Science in Computer Science
2. Master of Science in Telematics
3. Master of Science in Human Media Interaction

In chapter 4 of this study guide you can find information about the chairs and chair holders of the Computer Science department.
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1 COMPUTER SCIENCE
You are already familiar with the developments in information and communication technology and now you want to improve your knowledge and skills in this rapidly changing field. You want to specialize in specific subjects of choice, join a research group, and gain relevant experience in industry. The MSc Computer Science programme offers you the opportunity for all this, preparing you for specialist functions in industry or for a PhD and a career in science. We offer five specializations in current fields of research: Computer Security, Software Engineering, Information System Engineering, Methods and Tools for Verification and Wireless and Sensor Systems. As a master’s student you can choose a direction close to technology or close to a field of application such as healthcare, dependable systems, or learning and knowledge management.

1.1 GOALS AND AIMS OF COMPUTER SCIENCE

The common goals for the specializations in the master’s programme in Computer Science are established in the course rules. Basically it comes to this: the master’s programme aims to combine a scientific mindset with specialist technical knowledge, enabling graduates to analyze, design, validate and implement state-of-the-art ICT systems in their operational context. Graduates of the master’s programme are trained to take a scientific, ethical and socially responsible approach to conducting and contributing to research in their specific area of study and to international trends in and related to their field of study. The master’s programme aims to offer an engaging and challenging, research-oriented academic environment, enabling students to:

• acquire extensive knowledge and insight; develop their professional and scientific mindset by taking the initiative in and assuming responsibility for the learning process
• develop an inquisitive and reflective attitude
• understand and gain practical experience with methods and technologies for modeling and describing systems and their properties
• acquire a knowledge of, understand and gain practical experience with taking stock of the requirements of ICT systems (i.e. technology, design, validation and implementation) and of promising alternatives, and take informed decisions
• develop a constructively critical attitude in which decisions are substantiated and discussed
• work as part of a team in applying and/or developing theories, methods, technologies and tools pertinent to the development of ICT systems in their operational context
• gain practical experience working in complex, dynamic settings in which the information required is not always immediately available or complete

• be encouraged by means of an engaging curriculum (involving case studies, research projects, and discussions about research, trends and literature relevant to the discipline) to follow the trends in their field and use this information as a guide for and incorporate it into their own personal development.

The master’s programme also aims to encourage students who have the necessary affinity with and demonstrated talent for scientific research to continue on to pursue doctoral research. The course rules state the following domain-specific goals for the CSC programme. The CSC master’s programme strives to achieve the aims described below.

The CS master’s programme focuses on three themes:

• development of ICT systems in their commercial context
• technological aspects and applications of embedded systems
• development process of sophisticated software systems

Students will acquire specialist knowledge in one of these areas. The CSC master’s programme is designed for students with a thorough understanding of technology and of the functional and qualitative properties of systems and ability to evaluate and predict these properties and their context dependencies. System security, performance and efficiency are key areas of focus.

1.1.1 General scientific attainment levels

Graduates of the master’s programmes in the department of Computer Science will be able to meet the following scientific attainment targets:

a. Graduates have an extensive knowledge of and understand the issues relevant to their specific field of study (i.e. programme-specific attainment targets) described under 2 below.

b. Graduates can contribute to scientific research, and independently design, conduct and present the results of small-scale research.

c. Graduates can provide an original contribution to the development and/or application of the field of study.

d. Graduates can analyse complex problems (change problems) relevant to the field of study and obtain the required knowledge and information.

e. Graduates can design, validate and implement solutions/systems in their operational context; identify and apply relevant advanced knowledge, methods and techniques from their field of study.

f. Graduates can assess solutions/systems and their applications according to their properties
and potential to solve problems even if they are new to or unfamiliar with the situation or lack information and/or reliable information; they can use their assessment as a basis for (substantiation of) decisions.

g. Graduates understand the ethical, social, cultural and public aspects of problems and solutions in their field of study; apply this insight in their international role as scholar.

h. Graduates can work as part of and play a leading role in a team; manage and plan a development process; document development and research processes.

i. Graduates can substantiate research results, designs and applications in writing and verbally; critically assess and participate in debates regarding the same.

j. Graduates can independently acquire new knowledge and skills; reflect on trends in their field of study, responsibilities and roles and use this insight as a guide for and integrate it into their own personal development.

k. Graduates can integrate information from other disciplines into their own work if necessary.

l. Graduates take a critical approach to reading, incorporating information presented in and participating in debates regarding international scientific literature relevant to their field of study.

The word ‘original’ in c is understood to mean ‘demonstrative of a creative contribution’, and not ‘pioneering’.

1.1.2 Computer Science specific attainment levels

The final attainment levels of the Computer Science programme are in line with the Dublin descriptors:

a. Knowledge and understanding:
The graduates have demonstrated knowledge and understanding that is founded upon and extends and/or enhances that typically associated with Bachelor’s level, and that provides a basis or opportunity for originality in developing and/or applying ideas, often within a research context;

b. Application of knowledge and understanding:
The graduates can apply their knowledge and understanding, and problem solving abilities in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.

c. Formulate judgement:
The graduates have the ability to integrate knowledge and handle complexity, and formulate judgements with incomplete or limited information, but that include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgements;

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

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

In addition to the general attainment targets, CSC graduates will command a high level of scientific knowledge and understanding of computer science. This is demonstrated by their extensive knowledge and understanding of the technical aspects and design of ICT systems. In addition to a thorough understanding of these issues, CSC graduates also have a specialist knowledge and understanding of the chosen track.

1.2 GENERAL OUTLINE

There are six general rules to be observed by the student and study adviser in assessing the student’s possible course programme choices and in signing the finalized course programme. These general rules work differently according to programme, graduation subject field and track. See also section 1.3 of this guide.

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

2. The admissions board may grant a student admission with additional requirements, imposing additional diploma eligibility requirements. These requirements differ from student to student. No more than 30 credits will be required to satisfy the conditions imposed by the admissions board. The Master’s programme final assessment cannot be passed if the course programme of this category of students does not satisfy the additional requirements imposed. There are no exceptions to this rule.
1.3.1 Computer Security

Our society is dominated by the increasing role of computerised systems. However, as a side effect, the society becomes increasingly vulnerable to misuse of such systems. A large number of private Windows computers are infected with malware, privacy-leaks are commonplace in the Internet, and highly sophisticated malware like Stuxnet is targeting industrial installations. This explains the growing interest in and importance of computer security and privacy protection. The Kerckhoffs’s Computer Security specialization aims at educating those who will occupy the leading positions in this field.

Programme mentor:
Prof.dr. P.H. (Pieter) Hartel
Room: Zilverling 3001; Phone: 53 489 2411; E-mail: pieter.hartel@utwente.nl

This is a joint programme of three Dutch universities: the Radboud University Nijmegen (RU), the Technical University Eindhoven (TU/e) and the University Twente (UT). Participating students will have to take subjects and sit interim examinations at other universities. Some of the courses are given as tele-lectures.

The general aim is that students travel one day per week to another university and attend local courses or tele-lectures on the other days of the week.

Content of the course programme:
Six basic subjects of 6 credits each:
201000086 – Network security for Kerckhoffs students (UT)
192194100 – Cryptography 1 (TU/e)
192194200 – Verification of Security Protocols (TU/e)
192195100 – Software security (RU)
192195200 – Security in organizations (RU)
201100023 – Security and privacy in Mobile systems (UT) 1

At least three of the following nine advanced subjects of 6 credits each:
191210901 – Introduction to Biometrics (UT)
192194100 – Cryptography 1 (TU/e)
192194200 – Verification of Security Protocols (TU/e)
192195100 – Software Security (RU)
192195200 – Security in Organizations (RU)
201100023 – Security and Privacy in Mobile Systems (UT) 1
192121009101 – Secure software engineering (UT)
192121009102 – Software security (RU)
192110941 – Secure data management (UT)
192195400 – (Privacy) Seminar (RU)
192195300 – Hardware and operating systems security (RU)

1 Mandatory for students starting in the academic year 2011 or later.
Content of the course programme:

4 basic subjects:

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

At least one of the following 9 basic subjects:

- 192110720 - Distributed data processing using MapReduce
- 192110880 - Sensor data Management 1
- 192110941 - Secure data management
- 192110961 - XML & Databases 1
- 192150300 - Security in Information Services
- 192320501 - E-commerce
- 192320850 - Advanced requirements engineering (start module)
- 192330301 - Specification of information systems
- 192652150 - Service-oriented architecture with web services

At least 20 ECTS of the following advanced subjects:

- 192110860/61 - XML & databases 1/2
- 192110880/90 - Sensor data management 1/2
- 192160400 - Information retrieval
- 192320220 - Advanced architecture of information systems
- 192320850 - Advanced requirements engineering (follow up modules)

Elective subjects:

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

Mandatory (45 EC):

- 192199508 - Research topics (10 ec)
- 192199978 - Final Project (30 EC)

Graduation supervision is organized by the programme mentor.

1.3.2 Information Systems Engineering

Today’s organizations are vitally dependent on their information systems, and the high demands placed on these systems require skilled technical specialists. “Information Systems Engineering” graduates are experts and can be found at all stages of a distributed information system’s lifecycle (requirement analysis, architecture design, realization and maintenance). The information systems of today’s organizations manage large volumes of internal information, including structured and sensor data, multimedia data or geographic information. These systems encompass workflow, groupware and e-business processes and are often distributed across organizational units and physical locations.

Information system engineers are able to combine and configure basic software components, such as database management systems, transaction processing monitors, workflow management systems and middleware. In short, they know how to define a system on which an organization can truly depend without giving rise to any vulnerabilities.

Programme mentor:

Dr. A. (Andreas) Wombacher
Room: Zilverling 3098; Phone: 053 489 3772; E-mail:a.wombacher@utwente.nl

Graduation supervision is organized by the following chairs: Information Systems or Databases.
1.3.3 Software Engineering

In our daily life we are surrounded by devices like television sets, DVD players, mobile phones, etc. These devices are actually computer systems that execute software programs in order to perform their functions. The proper working of these devices, therefore, strongly depends on the proper working of the software, which these devices execute. Since these devices are proliferating and interacting with other systems in order to serve us in a multitude of ways and circumstances, the quality of software already plays a crucial role in our lives.

Therefore, Software Engineering focuses on applying techniques, guidelines, concepts, methods and tools that increase the quality of software in different products. The quality factors include, for example, performance, reliability, robustness and maintainability. The desired set of qualities usually conflict with each other and lead to trade-off decisions. The intricacies and intertwining of software qualities in different sorts of software systems make Software Engineering challenging and stimulating.

The Software Engineering programme covers the state-of-the-art topics necessary to design and maintain high quality software systems. Graduates of this programme will be able to create successful software systems that will have the right balance of the desired qualities.

Programme mentor:
Dr. ing. C.M. (Christoph) Bockisch
Room: Zilverling 5098, Phone: 053 489 3918; E-mail: c.m.bockisch@utwente.nl

The course programme includes the following unit of study:

Basic subject:
192340041 - Software management

At least 25 ECTS of the following basic subjects:
191511390 - Algebra
191520761 - Graph theory
191580752 - Deterministic models in OR
192111092 - Advanced logic
192111233 - Aspect-oriented programming
192111332 - Design of software architectures
192140122 - System Validation
192170015 - Testing Techniques
192320820 - Design science methodology
192330301 - Specification of information systems

At least 20 ECTS of the following advanced subjects:
192110280 - Advanced programming concepts
192135310 - Modeling and analysis of concurrent systems 1
192135320 - Modeling and analysis of concurrent systems 2
192135400 - ADSA-PL
192135450 - ADSA-MDE
192320850 - Advanced requirements engineering

Elective subjects

Other subjects to obtain the minimally required number of 120 credits may be chosen from the subjects offered by the Software Engineering group (XML Technologies, 192320550; Java Middleware Technologies, 192652110; Service-Oriented Architecture with Web Services, 192652150; and Patterns of Software Development, 192661001), the Formal Methods and Tools group (Performance Analysis, 192130500; Principles of Model Checking, 192114100; Quantitative Modeling and Analysis, 192114200) or from other specializations.

Mandatory (45 EC):
192166500 - Computer Ethics (5 EC)
192199508 - Research Topics (10 EC)
192199978 - Final Project (30 EC)

The programme should have a good balance between breadth and depth and has to be approved by the study adviser.

Graduation supervision is organized by the following chairs: Software Engineering or Formal Methods and Tools.

1.3.4 Methods and Tools for Verification

The Methods and Tools for Verification (MTV) programme is targeted towards ambitious computer science students, who want to become

- validation engineers, who know a broad range of validation techniques and tools, and know when and how to apply these techniques and tools within a system’s life cycle, and/or
- researchers, who want to do theoretical and foundational research in the realm of formal methods, and/or
At least 3 of the following 8 basic subjects:

- 191520761 - Graph Theory
- 191560561 - Introduction to mathematical systems theory
- 191580752 - Deterministic models in OR
- 192111233 - Aspect oriented Programming
- 192111332 - Design of Software Architectures
- 192620300 - Performance evaluation 1
- 192130092 - Fault tolerant digital systems
- 192130500 - Performance Analysis

At least 3 of the following advanced subjects:

- 192114100 - Principles of Model Checking
- 192114200 - Quantitative modeling and analysis
- 192114300 - Program Verification
- 192135320 - Modelling and Analysis of Concurrent Systems 2

At least one of the following advanced subjects:

- 191210441 - Control engineering
- 192111700 - Computability and Computational Complexity
- 192135450 - ADSA: Model driven engineering
- 192140700 - The numbers tell the tale (meten=weten)
- 192661001 - Patterns of software development

Elective subjects:

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

Mandatory (45 EC):

- 192166500 - Computer Ethics (5 EC)
- 192199508 - Research Topics (10 EC)
- 192199978 - Final Project (30 EC)

Graduation supervision is organized by the chair of Formal Methods and Tools.
1.3.5 Wireless and Sensor Systems

The Wireless and Sensor Systems programme addresses a new paradigm for bringing the flexibility of information technology to bear in every aspect of daily life. It foresees that people will be surrounded by embedded and flexibly (wirelessly) networked systems that provide easily accessible yet unobtrusive support for an open-ended range of activities, to enrich daily life and to increase productivity at work. These systems contain a mixture of hardware and software: their scope may be as simple as a sensor, or as complex as a portable device, or even an entire building or city. Cooperation is a necessity, to perform their tasks with sufficient quality or efficiency, and to reach the required functionality and support real time interactions. The specific nature of these systems require them to be open, scalable, adaptable and dependable, while integrating heterogeneous devices ranging from tiny actuators to larger computers. The programme WiSe studies not only the fundamentals of wireless and sensor systems, but also the context of the sensor systems. To this end, WiSe is a multidisciplinary and application oriented programme where you come in contact with different (technical as well as non-technical) disciplines and by doing so, it stimulates cooperation.

The WiSe master’s programme can also be followed as a Twente Graduate School Programme.

Programme mentor:
ir. Hans Scholten / prof.dr. P.J.M. (Paul) Havinga
Room: Zilverling 4016; Phone: 053 489 3733; E-mail: hans.scholten@utwente.nl

The course programme includes the following units of study:

Five compulsory core courses (25 EC):
- 192620010 Mobile & Wireless Networking I
- 191210750 System on Chip Design for ES
- 191211030 Ubiquitous Computing
- 192340041 Wireless Sensor networks
- 192166500 Computer Ethics

Three Elective courses (15 EC) out of the following:
- 192130112 Distributed Systems
- 191211030 Mobile Radio Communication
- 192620300 Performance Evaluation I
- 192620020 Mobile And Wireless Networking II

- 191210590 Embedded Signal Processing
- 192110880 Sensor Data Management

Elective courses (total 30 EC)
- 191211208 Internship (20 EC, not for HBO students)

Courses (10/30 EC) on topics related to:
- Flexible and efficient communication
- Distributed wireless systems
- Distributed data processing and reasoning

Graduation (40 EC):
- 191211749 Individual project (10 EC)
- 192199978 Final Project (30 EC)

1.3.6 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.
1.3.6.2 Dependable and Secure Computing

ICT systems are used as part of an ever-growing variety of applications and form a critical backbone of our societal infrastructure. Malfunctioning or sabotage of ICT systems incur economic expenses at best, cost lives at worse, or will even disrupt society.

An ICT-system is called dependable if reliance can justifiably be placed on the services it delivers. This should be possible despite the occurrence of physical faults, communication problems, software errors, human operator mistakes, or attacks by malicious intruders.

Dependability and security are interpreted in a broad sense. Depending on the application domain, it includes 7x24 availability, absolute safe and timely behavior, a guaranteed quality-of-service level, the protection of the integrity of financial transactions, enforcement of digital rights and the privacy of users.

Dependable ICT is a challenge, because applications tend to be geographically distributed, have increasingly complex and adaptive functionality, are connected via wired or wireless networks, and should be open for interaction with an unknown, sometimes malicious, environment.

In this Computer Science Graduate programme you will learn and develop traditional and novel methods and techniques for analyzing and constructing dependable and secure systems. Traditional means are fault and intrusion detection, prevention, prediction, removal, and tolerance, so that systems keep working even despite faults, errors, or hackers. Emphasis will be put on computational methods, in the following areas:

- Modeling, automated analysis and synthesis of dependable systems;
- Algorithms and protocols to enforce dependability and security;
- Design of dependable and secure software architectures.

Programme mentor:

This graduate school program is supported by the Design and Analysis of Communication Systems group (DACS), the Distributed and Embedded Security group (DIES), the Formal Methods and Tools group (FMT), and the Software Engineering group (SE).

Dr. M. (Marieke) Huisman
Room: Zilverling 5031; Phone: 053 489 4662; E-mail: m.huisman@utwente.nl

This graduate school program is supported by the Design and Analysis of Communication Systems group (DACS), the Distributed and Embedded Security group (DIES), the Formal Methods and Tools group (FMT), and the Software Engineering group (SE).

Dr. M. (Marieke) Huisman
Room: Zilverling 5031; Phone: 053 489 4662; E-mail: m.huisman@utwente.nl
The course programme includes the following units of study:

**Compulsory core courses (25 EC):**

- 192130092 - Fault tolerant Digital Systems
- 192140122 - System Validation
- 192194200 - Verification of Security Protocols (TU/e, 6EC)
- 192111332 - Design of Software Architectures
- 191210441 - Control Engineering

And depending on choice of track (30 EC):

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

- 192135310 - Modeling and Analysis of Concurrent Systems 1
- 192135320 - Modeling and Analysis of Concurrent Systems 2
- 192114200 - Quantitative Modeling and Analysis
- 192135450 - ADSA Model Driven Engineering
- 191580752 - Deterministic Models in OR
- 192130500 - Performance Analysis

**Track Secure Networks (SN):**

- 192654000 - Network Security
- 192110941 - Secure Data Management
- 192620010 - Mobile and Wireless Networking 1
- 192194100 - Cryptography 1 (TU/e)
- xxxxxxxxx - Cyber-crime Science
- 192130300 - Performance Evaluation

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

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

**Elective courses (15 EC):**

These consist of:

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

**Listed courses:**

- 192111092 - Advanced Logic (FMT)
- 192110280 - Advanced Programming Concepts (SE)
- 192111700 - Computability and Computational complexity (HMI)
- 192130112 - Distributed systems (PS)
- 191520751 - Graph Theory (DMMP)
- 192653100 - Internet Management and Measurement (DACS)
- 191210900 - Introduction to Biometrics (SAS)
- 191560561 - Introduction to Mathematical Systems Theory (MSCT)
- 192140700 - The Numbers tell the Tale (meten = weten)
- 192620020 - Mobile and Wireless Networking 2 (DACS)
- 191210341 - Physical Systems modeling of Embedded Systems (CE)
- 191211090 - Real-Time Software Development (EL)
- 192620000 - Telematics Networks (DACS)
- 191211080 - Systems Engineering (EL)

**Mandatory (55 EC):**

- Individual Specialization Assignment for Track A, B, or C (5 EC)
- 191812680 Computer Ethics
- International Research Orientation/Internship (15 EC)
- Master Thesis (including Research Proposal) (30 EC)

**1.3.6.3 Human-centred Interaction Technologies**

The subject of the Graduate programme Human-IT is the interaction between humans and ICT. It considers both the interaction of humans with the system and the interaction between humans through the technology. The rapidly grown availability and use of ICT in all aspects of the personal, organizational and societal life sphere during work, learning or free time, calls for a multidisciplinary and interdisciplinary approach of the subject, in which computer science and other engineering disciplines team up with social sciences and the humanities. This is fully reflected in this Graduate programme.
Depending on the track chosen by the student, the MSc phase can either be 1 or 2 years.

The Master phase of the project fulfils the requirements of one of the Master programmes participating in the Graduate Programme (either the MSc HMI – see chapter 3 of this study guide, or the MSc Computer Science, specialization Information Systems Engineering – see paragraph 1.3.2 of this study guide).

For more information about the course programme, please contact the programme mentor or check the following website: www.utwente.nl/tgs/programmes/human-centredinteractiontechnologies/

1.3.6.4 Services Science

Services science has emerged from the realization that the economy of physical products is being replaced by an economy of services that can be delivered with these goods. Information technology is the key enabling factor in this. It enables further globalization of commerce and production, but at the same time global connectedness in a service economy introduces new levels of architectural complexity and security risks, that need to be managed.

Nowadays services can be found everywhere and experienced and used anytime, in daily life, professional life, at consumer and business levels, and at technology levels. Traditional examples are transportation services, health services and education services.

Some newer examples are ICT outsourcing services, in which design or programming tasks are outsourced to specialized companies, and helpdesk services, which concentrate large numbers of calls from clients asking for help with products. We observe nowadays a trend to package products in services, so that added value can be offered to potential clients. An example is in contract manufacturing, such as for the automotive industry, where parts and equipment are provided on behalf of an original equipment manufacturer, possibly covering a range of activities such as design, prototyping, assembly, and quality assurance for complete products.

ICT is an enabler for the further growth of the services sector. Most business services and processes are supported by ICT services. The shift from products to services often implies an ICT-enabled provision of e-services. High-speed networks and powerful computer systems have made these processes ubiquitous. From the methodological side, the advent of the Service-Oriented Architecture has facilitated the mapping from business processes to ICT services, with the benefits of effectiveness and flexibility.

Services are essential, important and becoming quite complex as more interrelated services appear...
and more stakeholders or parties get involved. This means that services have to be approached from scientific, management and engineering points of view. Our Services Science programme has Management Science and Computer Science as cornerstones. It offers two study tracks, one going through a BIT Master and the other going through an CS Master, with each track following the rules of its related master’s programme, but having a clear ‘services science’ signature.

Programme mentor:
Prof. dr. R.J. (Roel) Wieringa
Room: Zilverling 3063; Phone: 053 489 4189; E-mail: r.j.wieringa@utwente.nl

The course programme includes the following units of study:

Four compulsory courses:
- 192320111 - Architecture of Information Systems
- 192110902 - Advanced Database Systems
- 192320501 - Electronic Commerce
- 192111332 - Design of Software Architecture

Five courses in Track A: Services technologies:
- 192652150 - Service-Oriented Architecture with Web Services
- 192110982 - Database Transactions and Processes
- 192330301 - Specification of Information Systems
- 192320550 - XML Technology
- 192135450 - ADSA- Model Driven Engineering

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

Four elective courses:
a. Compulsory courses from the other tracks.
b. Courses from the following list:
- 192320220 - Advanced Architecture of Information Systems
- 192320850 - Advanced Requirements Engineering

Mandatory (55 EC):
- Individual specialization assignment for Track A or B (5 EC)
- 191612680 Computer Ethics (5 EC)
- International research orientation/internship (15 EC)
- Master thesis (including research proposal) (30 EC)

1.4 PROGRAMME GUIDELINES

The student must complete the following steps to obtain course programme approval:
1. Orientation
   Students complete subjects and sit interim examinations as they see fit. In this phase only a few credits can be earned. During this phase, the student can be advised by the admissions board or, if the choice of track is clear, by a programme mentor (per specialization, see
section 1.3). If the student chooses subjects or projects during orientation without consultation of the admissions board or a programme mentor, he/she does so at his/her own risk. If 15 credits have been earned in the master’s programme, the orientation ends. At this point, permission from a programme mentor is required for a more complete programme of at least one year. Phase 2 begins. In case the student during orientation chooses only subjects and projects which are mandatory for any course programme (within a given graduation subject field or track), consultation with and approval by a programme mentor may be postponed to a maximum of 30 credits. No one can earn more than 30 credits in phase 1.

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

3. Approval of entire course programme
The programme mentor approves the 120-credit course programme in its entirety. At this point it is clear which chair/chairs will bear responsibility for the student’s graduation supervision. Students may reduce the term of Phase 1 and skip Phase 2. Regardless of how the student wishes to proceed, once the limit established for the orientation phase has been reached (i.e. 15 programme credits earned or 30 credits for mandatory units of study only), the programme mentor must be contacted.

1.5 SPECIAL PROGRAMME COMPONENTS

1.5.1 Premaster

Computer Science
In case you have a BSc in Computer Science from the University of Twente, Delft University of Technology or Eindhoven University of Technology you have full, unconditional admission to the master’s programme in Computer Science of the University of Twente. In case you have a BSc degree in Computer Science from a different university in Holland or a professional master’s degree (HBO) in Computer Science you can apply for admission at the Admission Office, see www.utwente.nl/admissionoffice. The Admission Office will decide if you can be admitted to the programme. By checking your previous programme on the aspects of programming, software engineering, computer architecture/organization, operating systems, information systems, databases and on some discrete mathematics, they will decide if a pre-master’s programme is necessary.

The pre-master’s programme will at least contain the course on algorithms, and courses on the aspects mentioned above that are lacking. In case there is too much discrepancy no pre-master’s programme will be allowed, and no admission is possible.

Telematics
In case you have a BSc in Computer Science from University Twente, Technical University Delft or Technical University Eindhoven you have full, unconditional, admission to our master’s programme in Telematics. In case you have a BSc degree from a different university in Holland in Computer Science or a professional master’s degree (HBO) in computer science or electrical engineering you can apply for admittance and the admission committee will judge if you can be admitted.

The committee will check your programme on the aspects of programming, software engineering, computer architecture/organization, operating systems, information systems, databases, telematics systems and mathematics.

If these aspects are sufficiently covered the premaster-package will be offered and will consist of a subset of: Calculus A and Calculus B, Linear Algebra A and Linear Algebra B, Probability Theory and Formal Methods Software Engineering.

1.5.2 Traineeship
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 at least 14 weeks.

Organization
The following persons and organizations play a role during your 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, which 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.

Options for a traineeship
Most students usually find a traineeship position at a company, but also an institution or university is possible. A traineeship 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 timetables 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, the procedure will be discussed and a planning will be made for the preparation, the traineeship itself and the completion after return. See your mediator at least six months before you plan to 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.
Traineeship Coördinator:
Dr. M.J. (Maarten) Korsten
Room: Zilverling 1022; Phone: 053 489 2779; E-mail: m.j.korsten@utwente.nl
Traineeship Mediator:
Mrs. B. (Belinda) Jaarsma
Room: Zilverling 1030; Phone: 053 489 3887; E-mail: b.jaarsma-knol@utwente.nl

1.5.3 Final Project
The final project is a 30-credit project completed over a half-year period, which rounds off the Master’s programme. It is a research and/or development exercise. While the final project is frequently an individual project, some students choose to complete the assignment in groups of two or more. The final project may be developed and implemented internally (within the UT), it may also involve a commissioned assignment from a company or another higher education institution. Some projects are completed abroad. The project usually follows a preceding Research topics. The final project is a ‘Master’s test’. In completing the project, the student demonstrates that he/she merits the Master of Science qualification.

While the substance of the assignment focuses on a specified field of study, it is assessed on the basis of a number of criteria. The following factors are key in earning a satisfactory result for the graduation assignment: to be able to clearly formulate a problem statement, to be able to identify relevant literature, to be able to draw up a work plan, to be able to adjust problem statement and work schedule in accordance with interim evaluations, to be able to analyse different possible solutions and to motivate a choice between them, to be able to communicate the research and design activities both written and in presentations, to show the ability of reflection on the problem, on the research/design
1.5.4 Study Abroad

A student is allowed to study 30 credits externally. To gain international experience a student is given the chance to go abroad to another university or institute to follow courses or doing projects. The choice of courses or projects has to be approved by the programme mentor in the same way as the other part of the programme is approved.

Carrying out a traineeship abroad (as described in par. 1.5.2) is one way of gaining international experience. In some cases it is possible to carry out the final project abroad under joint supervision, where the lead in supervision will always be taken by the own chair. Our faculty has agreements with partner universities and institutes to accommodate students smoothly. Information about going abroad to partner or non-partner universities/institutes, the procedures and the possibilities of financial support can be given by the coordinator of internationalization:

Drs. J. (Jan) Schut.
Room: Zilverling A-108 Phone: 053 489 4350; E-mail: j.schut@utwente.nl

1.5.5 Teaching degree

Graduates of the MSc Science Education and Communication – specialization Computer Science Education – receive the teaching license in computer science in secondary education. This master degree can be obtained as a second master degree, together with the master’s programme of Computer Science, Embedded Systems or Human Media Interaction. Combining these two programmes takes an extra year. Students get an extra year of study finance. More information can be given by drs. N.M. (Nico) van Diepen, didactician computer science; e-mail: n.m.vandiepen@utwente.nl.
See also: graduate.utwente.nl/sec/

1.6 Organization

1.6.1 Programme Director

The programme director for the master’s programme Computer Science is dr. ir. R. (Rom) Langerak. You can find him in building Zilverling, room 5039; Phone: 053 489 3714; E-mail: r.langerak@utwente.nl
1.6.5 Study adviser

The study adviser supports students during (study) problems that they might encounter. Besides programme-related problems, students can contact the study adviser for questions about studying, planning, complaints, educational and examination regulations and your legal position. The study adviser is the confidant for students.

The study advisers for Computer Science are S.B.A.M. (Sharon) Vonk and L. (Lilian) Spijker, MSc; Room Zilverling 1004; Phone: +3153 489 5645; E-mail: s.b.a.m.vonk@utwente.nl or l.spijker@utwente.nl

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1.6.2 Programme Coordinator

The programme coordinator for the master’s programme Computer Science is drs. J. (Jan) Schut. You can find him in building Zilverling, room A 108; Phone: +3153 489 4350, E-mail j.schut@utwente.nl

1.6.3 Programme Mentor

The diploma is earned by obtaining satisfactory assessment results for each of the various units of study. The Examination Board ultimately determines whether the student’s results make him/her eligible for the diploma. This determination includes an assessment of whether the subjects and projects completed satisfy the applicable requirements and whether the level of the results achieved merit the diploma. The student has a great deal of freedom in selecting the subjects and projects completed towards earning the diploma. The entire list of units of study selected and completed by the student is called the course programme.

The conditions placed on selecting subjects and projects are sometimes easy to meet, but is still mandatory in all cases that the student obtains formal approval for the choices he/she makes.

The Examination Board appoints programme mentors who, on its behalf, assess the choices made by students in completing their programme according to the applicable regulations and any additional requirements imposed by the admissions board. If assessed positively, the programme mentors then approve the students’ course programmes on behalf of the Examination Board.

The course programme conditions are presented in the ‘Course Programmes’ section below. The conditions placed on the course programmes differ according to programme, track and specialization.

Every programme has its own programme mentor. Programmes offering various specializations and graduation subject fields generally have programme mentors for each specialization and graduation field. You will find the name of your programme mentor in section 1.3.

1.6.4 Coordinator International Students

The coordinator for international students is drs. J. (Jan) Schut. He can be contacted for any questions about the programme; Room Zilverling A 108; Phone +3153 489 4350; E-mail j.schut@utwente.nl
2 TELEMATICS
2.1 GOALS AND AIMS OF TELEMATICS

Telematics focuses on improving the interaction between people and/or automated processes over time and distance through the application of information and communication technology. Telematics lays the foundation for connecting today’s demanding users worldwide. Ever increasing bandwidth, growing mobility, new applications every day, a variety of standards having to work together without problems: these all are challenges for the telematics expert.

In order to meet these challenges, the telematics expert needs knowledge about and insight in a broad range of topics: fixed/wired and mobile/wireless networking technologies; design methods and performance evaluation tools; network management and security issues; and of course services and applications.

The telematics programme ensures that students familiarize themselves with all core topics in telematics, while also offering them a choice of relevant courses that focus more on specific aspects. The programme does not have a formal set of specializations to choose from; instead, each student composes his/her own programme, within some given constraints (see section 2.3), and subject to approval by the programme mentor. Thus, each student can tune the programme to his/her interests and ambitions.

2.1.1 General scientific attainment levels

The Telematics programme has the following general scientific attainment levels. These describe the general academic skills (not specific to Telematics) that a student acquires in the program.

a. Graduates have an extensive knowledge of and understand the issues relevant to their specific field of study (as detailed in section 2.1.2).

b. Graduates can contribute to scientific research, and independently design, conduct and present the results of small-scale research.

c. Graduates can provide an original contribution to the development and/or application of the field of study.

d. Graduates can analyse complex problems (change problems) relevant to the field of study and obtain the required knowledge and information.

e. Graduates can design, validate and implement solutions/systems in their operational context; identify and apply relevant advanced knowledge, methods and techniques from their field of study.

f. Graduates can assess solutions/systems and their applications according to their properties and potential to solve problems even if they are new to or unfamiliar with the situation or lack information and/or reliable information; they can use their assessment as a basis for (substantiation of) decisions.

g. Graduates understand the ethical, social, cultural and public aspects of problems and solutions in their field of study; apply this insight in their international role as scholar.

h. Graduates can work as part of and play a leading role in a team; manage and plan a development process; document development and research processes.

i. Graduates can substantiate research results, designs and applications in writing and verbally; critically assess and participate in debates regarding the same.

j. Graduates can independently acquire new knowledge and skills; reflect on trends in their field of study, responsibilities and roles and use this insight as a guide for and integrate it into their own personal development.

k. Graduates can integrate information from other disciplines into their own work if necessary.

l. Graduates take a critical approach to reading, incorporating information presented in and participating in debates regarding international scientific literature relevant to their field of study.

The word ‘original’ in c is understood to mean ‘demonstrative of a creative contribution’, and not ‘pioneering’.

2.1.2 Telematics-specific attainment levels

The qualification under ‘a’ in the preceding section, that graduates command a high level of scientific knowledge and understanding of Telematics, is demonstrated by their ability to:

TEL 1. apply in a structured manner, disseminate and incorporate in multidisciplinary projects extensive knowledge and understanding of technology, development and application of data transmission, data communication, networks, protocols and their interrelations,

TEL 2. maintain a comprehensive overview of and analyze the telematics service and application needs of organizations, incorporate these needs into the telematics application development process and integrate them into business processes,

TEL 3. assess sophisticated problems in the field of telematics, develop solutions/solution structures for them and translate these into concrete designs and implementation,

TEL 4. have a thorough knowledge of, understand and gain practical experience with the process and available methods and technologies for planning, managing and implementing system development for
telematics systems and applications,

TEL 5. apply methods, techniques and design and development tools for the development of telematics applications, networks and services, make an informed selection of these, communicate the principles involved and contribute to their further development,

TEL 6. select and implement the methods, techniques and tools to formally specify, verify and test telematics systems,

TEL 7. have knowledge of and understand various aspects of telematics systems, including performance, security and reliability; be able to apply this knowledge,

TEL 8. integrate, both independently and as part of a team, telematics systems, services and networks into large-scale telematics infrastructures, and maintain a comprehensive overview of the consequences,

TEL 9. have knowledge of and understand the trends in the field of study and the interaction between technological innovations and the organizational context of their applications.

Telematics graduates have specialist knowledge of telematics and practical experience with scientific research and are able to contribute and apply the results.

2.2 GENERAL OUTLINE

The total size of the master’s programme is 120 EC (European Credits, where 1 Credit represents 28 hours of work), spread over 2 years. The first year is filled with regular courses, some of which are obligatory (25 EC, see section 2.3.1), some can be chosen within certain constraints (30 EC, see section 2.3.2), and some of which can be chosen freely (albeit subject to approval by the programme mentor). The second year may contain some more regular courses, and may contain a 20 EC traineeship (i.e., working for a few months at a company). It definitely contains the 30 EC final project, and the 10 EC ‘research topics’, which is usually a literature study as a preparation to the final project.

In contrast to some of the other programs of the department, the Telematics programme does not have pre-defined specializations to choose from. Instead, tuning your programme to the specific area within Telematics that you are most interested in, is done on an individual basis, in discussion with the programme-mentor.

The admission committee may have imposed extra constraints on your study programme, to ensure a good match between your bachelor programme and the Telematics master programme. Such extra constraints come in two flavors:

1. Homologation courses: these are courses that you have to include in your programme, in the space for free courses. Thus, they fall within the 120 EC of the total programme.

2. Deficiency or pre-master courses: these are courses that you have to do in addition to the 120 EC of the regular programme.

2.3 MASTER’S PROGRAMME

2.3.1. Core courses

The programme contains the following core courses, of 5 EC each:

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Course code</th>
<th>Course name</th>
<th>Course code</th>
<th>Course name</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>192620010</td>
<td>Mobile and wireless networking 1</td>
<td>192620300</td>
<td>Performance evaluation</td>
</tr>
<tr>
<td>2</td>
<td>192652150</td>
<td>Service oriented architecture with web services</td>
<td>192654000</td>
<td>Network security (*)</td>
</tr>
<tr>
<td>1</td>
<td>192166500</td>
<td>Computer ethics (**)</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

(*) UT students may already have taken Network security as an elective course in their bachelor programme; in that case, they should do another free course instead.

(**) Computer ethics is not specifically about Telematics, but obligatory for all master students in the UT’s computer science related programs.

2.3.2 Advanced courses

The programme must contain at least 1 (i.e., at least 5 EC) of the following advanced courses on modeling and validation:

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Course code</th>
<th>Course name</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>192130500</td>
<td>Performance analysis</td>
</tr>
<tr>
<td>4</td>
<td>192140122</td>
<td>System validation</td>
</tr>
<tr>
<td>3</td>
<td>192170015</td>
<td>Testing techniques</td>
</tr>
</tbody>
</table>
2.3.3 Elective courses

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

A traineeship of 20 EC may be part of this; see section 1.5.2.

2.3.4 Final project and research topics

The study programme is completed by the Research Topics (192199508, 10 EC) and the Final project (192699978, 30 EC). For more information, see section 1.5.3.

2.4 PROGRAMME GUIDELINES

Guidelines for organizing your study programme for Telematics are the same as those for the Computer Science programme; see section 1.4 of this guide.

These guidelines concern both practical issues such as how and when to plan which courses you take, and some formal rules about the composition of your course package, taking courses abroad, etc.

2.5 SPECIAL PROGRAMME COMPONENTS

For more information on the possibility and procedures for a pre-master’s programme, including a traineeship in your programme, the preparation and organization of the final project, the possibility of studying abroad, and the possibility of obtaining a teaching degree, you are referred to section 1.5 in the Computer Science part of this guide.

2.6 ORGANIZATION

2.6.1 Programme Director

The programme director for the master’s programme

Computer Science is dr. ir. R. (Rom) Langerak. You can find him in building Zilverling, room 5039;

Phone: 053 489 3714; E-mail: r.langerak@utwente.nl
2.6.2 Programme Coordinator

The programme coordinator for the master’s programme Computer Science is drs. J. (Jan) Schut.
You can find him in building Zilverling, room A 108; Phone: 053 489 4350, E-mail j.schut@utwente.nl

2.6.3 Programme Mentor

The programme mentor for the master’s programme Telematics is dr. ir. P.T. (Pieter-Tjerk) de Boer. You can find him in building Zilverling, room 5016; Phone: 053 489 4327, E-mail: ptdeboer@utwente.nl.

You can make an appointment with him:

• if you are interested in following master’s programme Telematics.
• if you would like to tailor the master’s programme Telematics to your specific needs.
• to discuss and get approval for the courses you intend to follow as part of your master’s programme Telematics. Note that getting approval (thus a signature) is a requirement; see also the rules about this above.

2.6.4 Coordinator International Students

The coordinator for international students is drs. J. (Jan) Schut. He can be contacted for any questions about the programme. Room Zilverling A 108; Phone: 053 489 4350; E-mail j.schut@utwente.nl

2.6.5 Study Adviser

The study adviser supports students during (study) problems that they might encounter. Besides programme-related problems, students can contact the study adviser for questions about studying, planning, complaints, educational and examination regulations and your legal position. The study adviser is the confidant for students.

The study advisers for Computer Science are S.B.A.M. (Sharon) Vonk and L. (Lilian) Spijker, MSc; Room Zilverling 1004; Phone: 053 489 5645; E-mail: s.b.a.m.vonk@utwente.nl or l.spijker@utwente.nl
3 HUMAN MEDIA INTERACTION
3.1 GOALS AND AIMS OF HUMAN MEDIA INTERACTION

Highlighting the interaction between people and technology, the HMI master’s programme studies this relationship from different perspectives. Special emphasis is placed on the manner in which people interact with technology (i.e. what are their requirements, abilities and limitations?) and on the identification of the best way to implement or further develop technical capabilities to meet the needs of users.

The HMI master’s programme focuses specifically on intelligent, multimodal systems offering a more natural form of interaction than currently possible with conventional monitors, mice and keyboards. By employing a broad range of input modalities to observe and intelligently interpret user actions, these intelligent interactive systems aim to automatically determine the user objectives and operational context and make the necessary adjustments. This multimodality applies both to system input and output; text, speech, haptic and visual feedback and all manner of communication media are integrated and presented to users in an intelligent manner.

The HMI programme combines technical expertise and skills in the field of interaction technology with knowledge and skills in user-oriented design methodologies and an understanding of how people interact with technology.

In collaboration with the University of Trento, Italy, the HMI programme also offers the possibility for students to obtain a double degree.

3.1.1 General scientific attainment levels

The degree programme has the following general scientific attainment levels

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

The word ‘original’ in c is understood to mean ‘demonstrative of a creative contribution’, and not ‘pioneering’.

3.1.2 Human Media Interaction specific attainment levels

The qualification under ‘a’ above, that HMI graduates command a high level of scientific knowledge and understanding of human media interaction, is elaborated as follows.
a. Graduates have a thorough knowledge and understandings of each of the sub-fields listed below and identify and utilize any links:

   • methodology of user-oriented design, including the drafting of user requirements, user studies and usability engineering;
   • forms of natural interaction, including natural language and speech recognition technology, multimodal interaction and interaction via dialogue systems and conversational agents;
   • intelligent interaction employing techniques taken from artificial intelligence, e.g. intelligent multi-agent systems and learning systems;
Each student has an individual course programme which meets the programme requirements and general guidelines (section 3.3). The requirements (section 3.3) and the general guidelines (section 3.4) define Graduate School students as a particular type of student, to whom other requirements may apply than the general requirements for all students. Graduate School students are students who have been admitted to the Human Centred Interaction Technologies (HCIT) programme of the Twente Graduate School, and for whom the HMi master’s programme constitutes the initial phase of their HCIT programme. For more information about Twente Graduate School and the HCIT specialization, see section 1.3.6.

The requirements set in (section 3.3) and in the general guidelines (section 3.4) distinguish Trento Double Degree students (shortly TDD students) as a particular type of student, to whom other requirements may apply than the general requirements for all students. Trento Double Degree students are students who participate in the double degree agreement of the University of Twente HMi programme and the University of Trento (Italy) LMI (Language and Multimodal Interaction) programme. TDD students are either TDD entry students, who study their first year in Twente and their second year in Trento, or TDD exit students, who study their first year in Trento and their second year in Twente. See section 3.5.6 for more information about the double degree programme.

The regulations for the approval of the student’s course programme (within the rules and restrictions of the programme) are in section 3.4.

The Examination Board appoints a programme mentor to advise students in their choices. The programme mentor will have the authority to approve student’s programmes on behalf of the Examination Board.

In addition to the programme students who will be admitted to the programme on the basis of a Bachelor’s degree awarded by a Dutch institute of professional education (HBO) must also complete a pre-Master’s programme. See the description in section 3.5.

### 3.3 Master’s Programme

#### 3.3.1 Basic Subjects

The core units of the HMi master’s programme are outlined in Table 1.

Students must choose their basic courses among the core units of Table 1, totaling 40 EC in study load. Graduate School students must make their choice totaling 50 EC in study load. The choice for...
all students is limited by the following rules. (The implication of these rules for Trento Double Degree students is outlined after Table 1.)

- The basic courses must include units in the area Human Computer Interaction with a study load of at least 5 EC in total;
- The basic courses must include units in the area Natural Interaction with a study load of at least 5 EC in total;
- The basic courses must include units in the area Artificial Intelligence with a study load of at least 5 EC in total;
- The basic courses must include units in the area Man, Media and Society with a study load of at least 10 EC and at most 15 EC in total. It is mandatory that Computer Ethics (191612680) is among the basic subjects in this area.
- The basic courses must include a HMI project (192166100). 2
- The courses marked -i- in Table 1 are ‘introductory’ units of study. The number of introductory units of study included in the basic courses is limited by the following rule: The course programme can include no more than 30 credits from ‘introductory’ units of study.

For Graduate School students an additional requirement is imposed: - The basic courses of a Graduate School student must include all units in the Human Centered IT area.

For Trento Double Degree an additional requirement is imposed.
- The four courses of the LMI programme in Table 1a are mandatory.

This additional requirement constitutes a specific way to meet the basic HMI requirements. It applies to TDD students only. Table 1a shows how the mandatory LMI courses are used to meet part of the HMI basic requirements.

Table 1: Basic courses and their areas

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Study Load</th>
<th>Assessment</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>192320601 Multi agent systems</td>
<td>5</td>
<td>S, O</td>
<td></td>
</tr>
<tr>
<td>192160200 Knowledge Representation</td>
<td>10</td>
<td>S, O</td>
<td></td>
</tr>
<tr>
<td>192186420 Machine learning</td>
<td>10</td>
<td>O</td>
<td></td>
</tr>
</tbody>
</table>

2 It is possible to have more than one instance of a unit of study in a course programme (e.g. HMI project, Capita Selecta). Of course the approval of the programme mentor is needed. The difference between the two must be clear to all parties.
Prerequisites:
1. This course is excluded from the provisions of article 4 under 3 of the Teaching and Examination Regulations. Students must have a Bachelor’s diploma and (or) a certificate of admission to sit the interim examination.
2. To be eligible for 192166320 Speech and language processing 2 the student must have successfully completed 192166310 Speech and language processing 1.

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

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

Table 1a mandatory Trento courses for TDD students

<table>
<thead>
<tr>
<th>study load in EC</th>
<th>area in which the course counts for the basic subject requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine learning 6</td>
<td>Artificial Intelligence</td>
</tr>
<tr>
<td>Topics in Cognitive Psychology 8</td>
<td>Man, media, society</td>
</tr>
<tr>
<td>Topics in Cognitive Neuroscience 8</td>
<td>Natural Interaction</td>
</tr>
<tr>
<td>Language Resources and Ontologies 5</td>
<td>Natural Interaction</td>
</tr>
</tbody>
</table>

To meet the basic requirements, a TDD student has to take these four courses in Trento plus at least in Twente:
- Unit(s) in the area Human Computer Interaction (5 EC or more).
- Computer Ethics (191612880)
- A HMI project (192166100).
- Research design (6 EC, mandatory): category “Human Computer Interaction”. The course is broad and (among others) covers research ethics.

3.3.2 Advanced courses
Advanced courses are units of study chosen from the core HMI units in Table 1 that are not included in the basic subjects described in section 3.3.1.
The choice of courses is limited by the following rules:
- Advanced courses include no introductory units.
- The course programme includes no more than 15 EC units in the area Man, Media and Society.

3.3.3 Elective courses and homologation courses
Elective courses are courses not taken from Table 1. They are chosen upon advice of the programme mentor.
TDD students can take courses at Trento which are not in Table 1a as elective courses.
The choice of courses is limited by the following rule: The course programme includes no more than 15 EC units in the area Man, Media and Society.
In some cases the admissions board may issue a certificate of admission with additional requirements. Generally the student will use the space for elective courses in his course programme to meet these additional requirements, usually called ‘homologation’. Consequently he can take less or no elective courses.

3.3.4 (Research) Traineeship, research topics
1. Graduate school students must take a 15 EC research traineeship in their course programme.
2. Ento Double Degree students must take the 6 EC Research design course at Trento in their course programme.
3. All students except Graduate School students may take a 20 EC traineeship in their course programme. A student who must take homologation (see section e) courses can skip a traineeship.
3.4 PROGRAMME GUIDELINES

There are nine general rules to be observed by the student and programme mentor in assessing the student’s possible course programme choices and in signing the finalised course programme. These general rules work differently according to programme, graduation subject field and track.

1. The student creates a programme of units of study totaling 120 credits. These units are selected from among the courses offered by the UT or, where beneficial, courses offered by other universities. All course programmes except for Graduate School students have to include a 30-credit graduation assignment, and a 10-credit Research Topics unit. Graduate School students have to include a 15 credit research internship and a 30 credit graduation assignment. Trento Double Degree students have to include the 15 credits Trento course Research design, and the 30 credit graduation assignment. Students with a course programme totaling fewer than 120 credits or one lacking a graduation assignment of at least 30 credits will not successfully pass the master’s programme final assessment. There are no exceptions to this rule, except that the Examination Board may grant a student exemption from the mandatory 10 credits Research Topics.

2. The admissions board may grant a student admission with additional requirements, imposing additional diploma eligibility requirements. These requirements differ from student to student. No more than 30 credits will be required to satisfy the conditions imposed by the admissions board. The master’s programme final assessment cannot be passed if the course programme of this category of students does not satisfy the additional requirements imposed. There are no exceptions to this rule.

3. Requirements apply to each course programme to ensure basic knowledge in the field of study and the track selected. The admissions board may adjust these requirements on the basis of the student’s prior education and training. Such an adjustment will never entail an intensification of the requirements. The master’s programme final assessment cannot be passed if the course programme does not satisfy the basic knowledge requirements. The only exception to this rule is when the admissions board lowers the basic knowledge requirements.

4. Requirements apply to each course programme to ensure sufficient depth of study in the track selected. The manner in which these requirements are satisfied is determined in consultation with the programme mentor. This includes, where necessary, taking into account which chair/chairs will bear responsibility for the student’s graduation supervision. The master’s programme final assessment cannot be passed if the course programme does not satisfy the depth of study requirements. There are no exceptions to this rule.

5. Requirements apply to some course programmes governing the chair from which the student can complete his/her studies, according to the graduation subject field or track selected. The master’s programme final assessment cannot be passed if, during the course of study, the requirements for the composition of the graduation committee are not satisfied. There are no exceptions to this rule.

6. One guideline applicable to all course programmes is that continuing students (i.e. holders of a UT Bachelor’s diploma eligible for automatic admission to one of the master’s programmes) can complete part of the programme’s 120 credits outside of the UT. The Examination Board may decide to exempt an individual from this guideline. The total number of credits completed at the UT or at another university or research institute approved by the programme mentor, must be at least 90, except for Trento Double Degree students, who complete exactly 60 credits at the UT. The Examination Board may permit a student to deviate from this rule. Additional requirements with regard to the type of activities completed by students outside of the UT may be posed. For instance, the obligation that a student completes a traineeship. Such a requirement must involve no more than 30 credits. The master’s programme final assessment cannot be passed if the course programme does not satisfy the requirements imposed with regard to the units of study completed outside of the UT, unless an exemption has been granted.

7. It is possible to have more than one instance of a unit of study (e.g. HMI project, Capita Selecta) in a course programme. Of course the approval of the programme mentor is needed. The difference between the two must be clear to all parties.

8. To be eligible for 192166320 Speech and language processing 2 the student must have successfully completed 192166310 Speech and language processing 1.
Once the programme mentor and the student reach an agreement on the content of the course programme, they complete and sign the forms. The programme mentor signs on behalf of the Examination Board.

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

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

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

3.5 SPECIAL PROGRAMME COMPONENTS

3.5.1 Premaster

In case you have a BSc in Computer Science from a Dutch university you have full, unconditional, admission to our master’s programme in Human Media Interaction. In case you have a different bachelor’s degree or a professional master’s degree (HBO) in Computer Science you can apply for admittance at the Admission Office, see www.utwente.nl/admissionoffice. The same goes for having a bachelor’s degree or professional master’s degree in a discipline in Artificial Intelligence, Mediatechnology, Creative Technology, Design and whatever you judge could be equivalent here. The admission committee will judge whether you can be admitted to the programme.

The committee will check your programme on the aspects of programming, software engineering, computerarchitecture/organization, operating systems, information systems, databases, artificial intelligence and on mathematics.

Based on this the Admission Office will come up with a pre-master’s programme consisting of courses on the aspects mentioned above that are lacking. In case there is too much discrepancy no pre-master’s programme will be allowed, and no admission is possible.

3.5.2 Traineeship

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 at least 14 weeks.

Organization

The following persons and organizations play a role during your 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, which 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.

Options for a traineeship

Most students usually find a traineeship position at a company, but also an institution or university is possible. A traineeship 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 timetables 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, the procedure will be discussed and a planning will be made for the preparation, the traineeship itself and the completion after return. See your mediator at least six months before you plan to 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.

Traineeship Coordinator:
Dr. M.J. (Maarten) Korsten
Room: Zilverling 1022; Phone: 053 489 2779;
E-mail: m.j.korsten@utwente.nl

Traineeship Mediator:
Mrs. B. (Belinda) Jaarsma
Room: Zilverling 1030; Phone: 053 489 3887;
E-mail: b.jaarsma-knol@utwente.nl

3.5.3 Final project

1. Students complete graduation work (final project) worth 30 credits. For Trento Double degree students the following holds: if they are entry students (starting in Twente) they complete their graduation work in Trento; if they are exit students (starting in Trento) they complete their graduation work in Twente.
2. Graduation work consists of a graduation project, a graduation report, a summary of the report, and a presentation. Generally the Research topics above immediately precede the graduation
work, and serve as a preparation for the graduation work.

3. Students may start graduation work only if they have completed all of the remaining components of the study programme. The regulation of Article 4 under 3 (TER) does not apply.

4. Faculty chairs take responsibility for supervision and assessment of graduation work. For the M-HMI programme the chair responsible is HMI. For Trento Degree students the supervision is a joint effort by HMI and LMI.

The final project should 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. The report should also contain a text reflecting upon the relevance of the research work of the final project in the society.

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.

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

3.5.4 Study Abroad

A student is allowed to study 30 credits externally. To gain international experience a student is given the chance to study abroad to another university or institute to follow courses or doing projects. The choice of courses or projects has to be approved by the programme mentor in the same way as the other part of the programme is approved.

Carrying out a traineeship abroad (as described in par. 3.5.2) is one way of gaining international experience. In some cases it is possible to carry out the final project abroad under joint supervision, where the lead in supervision will always be taken by the own chair. Our faculty has agreements with partner universities and institutes to accommodate students smoothly. Information about going abroad to partner or non-partner universities/institutes, the procedures and the possibilities of financial support can be given by the coordinator of internationalization:

Drs. J. (Jan) Schut.
Room: Zilverling A-108 Phone: 053 489 4350; E-mail: j.schut@utwente.nl
3.5.5 Teaching degree
Graduates of the MSc Science Education and Communication – specialization Computer Science Education – receive the teaching license in computer science in secondary education. This master degree can be obtained as a second master degree, together with the master’s programme of Computer Science, Embedded Systems or Human Media Interaction. Combining these two programmes takes an extra year. Students get an extra year of study finance. More information can be given by drs. N.M. (Nico) van Diepen, didactician computer science; e-mail: n.m.vandiepen@utwente.nl. See also: graduate.utwente.nl/sec/

3.5.6 Trento Double Degree programme
The HMI Programme collaborates with the International Master Programme in Cognitive Science of the University of Trento in Italy. For students this means that there are exchange possibilities. One option is to go to Italy for half a year according to an Erasmus exchange programme. The other option is to enroll in the Double Degree Programme. In that case, the second year is spent in Italy and both universities sign the diploma. Both options are subject to restrictions and both are subject to prior approval by the programme mentor. You should also contact the Coordinator International Students.

3.6 ORGANIZATION

3.6.1 Programme Director
The programme director for the master’s programme Human Media Interaction is dr. G.F. (Gerrit) van der Hoeven. You can find him in building Zilverling, room 1096; Phone: 053 489 3708; E-mail: g.f.vanderhoeven@utwente.nl.

3.6.2 Programme Coordinator
The programme coordinator for the master’s programme Human Media Interaction is drs. J. (Jan) Schut. You can find him in building Zilverling, room A 108; Phone: 053 489 4350; E-mail: j.schut@utwente.nl.

3.6.3 Programme Mentor
The programme mentor is appointed by the Examination Board to advise students in their choices, and with the power to grant the approval of their course programme. The regulations for the approval of the student’s course programme (within the rules and restrictions of the programme, as outlined in 3.3) are in section 3.3.7.

Students can contact the programme mentor anytime to get advice on courses to take, internships, research topics or research assignments.

The programme mentor for the master’s programme Human Media Interaction is Dr. (Dirk) Heylen. You can find him in building Zilverling, room 2031; Phone: 053 489 3745; E-mail: d.k.j.heylen@utwente.nl.

3.6.4 Coordinator International Students
The coordinator for international students is drs. J. (Jan) Schut. He can be contacted for any questions about the programme. You can find him in building Zilverling, room A 108; Phone: 053 489 4350; E-mail: j.schut@utwente.nl.

3.6.5 Study Adviser
The study adviser for HMI students is drs. T. (Thea) de Kluijver. If you have any questions about the regulations within the programme, or if you want to talk about study related issues, you can contact her. Building Zilverling, room 1003; Phone: 053 489 3697; E-mail: t.h.dekluijver@utwente.nl.
4 CHAIRS
4.1 COMPUTER ARCHITECTURE FOR EMBEDDED SYSTEMS (CAES)

‘ENERGY EFFICIENT ARCHITECTURES’

Our mission is to perform research on energy-efficient dependable architectures for networked embedded systems, by combining efficient computer architectures, systems software, networking, and tools.

Energy-efficiency is important for streaming applications found in battery powered mobile devices (e.g., PDAs and portable multimedia players) but also in high-performance computers. The research on energy efficient architectures focuses on reconfigurable processors for streaming applications.

In cooperation with Recore Systems, a spin-off company of our group, we developed an energy efficient reconfigurable architecture called the Montium\(^*\). In real life the Montium is a Chameleon, a reptile that adapts to its environment, also our Montium adapts to its environment.

In cooperation with Atmel, specialist in design and manufacture of advanced semiconductors, a reconfigurable multi-processor System-on-Chip (MPSoC) called the Annabelle is produced that contains 4 reconfigurable Montium tiles in CMOS technology (2 mm\(^2\) per Montium)\(^*\).

An interesting high-performance streaming application is medical image processing. For example: a doctor wants in real time X-ray images of the patient during surgery. Also signal processing for phased array antennas (for radar and radio astronomy) is part of our research.

In MPSoC systems for streaming applications dependability (i.e. availability, reliability, integrity and maintainability) techniques play an important role. One of the problems in manufacturing a MPSoC with millions of transistors using deep-submicron technologies (90 nm and below), is an increase in the probability of defects in silicon, which results in decreasing manufacturing yield. We develop methods to deal effectively with the increased defect density for fault detection, localization, and fault tolerant architectures implemented on-chip.

Not only mobile devices can profit from energy efficient solutions. In cooperation with E.ON, Essent and HOMA software, we work on the successor of the classic (high-efficiency) boiler in your home: the Micro Combined Heat and Power System (microCHP).

The microCHP produces heat but also electricity, that can be used during peak load or during power outage. Due to the reduced peak load energy is generated more efficiently. We concentrate on the peak load reduction within a single household, scheduling a fleet of microCHPs and islanded operation in case of power outage.

Prof.dr.ir. G.J.M. Smit

4.2 DESIGN AND ANALYSIS OF COMMUNICATION SYSTEMS (DACS)

‘AVOID THE RAIN’

One of the first things I’ll do every morning, is to go to the living room and take a look at the screen of my Apple notebook. This screen not only gives the latest news, but also shows the radar pictures that predict whether and where rain will fall within the next few hours. Depending on these pictures, the decision is made whether I’ll go by bike, or by car to the UT.

Next to me, there are everyday millions of users worldwide that depend on infrastructures like the Internet and GSM/UMTS networks for making decisions. Although these infrastructures are continuously getting faster, the key challenge however is to make these infrastructures more reliable.

The Design and Analysis of Communication Systems (DACS) group therefore focuses on dependable networked systems.

Research and education within DACS covers the whole spectrum of network technologies: from well-established technologies (like the wired Internet), via technologies that are under development (such as wireless networks) to emerging technologies (like embedded network systems).

In the case of well-established technologies, research concentrates on operational aspects, here, in particular, of the wired Internet. Specific topics include bandwidth allocation, accounting, self-management of lambda switches and protection against scans, denial-of-service attacks and phishing.

Taking and interpreting measurements plays an important role in research. For technologies under development, research focuses on the design, evaluation, and prototype implementation of new protocols and algorithms for wireless and ad-hoc networks. Topics include algorithms for context- and power-aware routing in ad-hoc networks, and, lately, more and more on car-to-car communications and wireless sensor networks.

The research on embedded networking technologies focuses on system specification and evaluation techniques to describe such systems, and the resource constraints (performance, dependability,
energy usage they have to operate under. This includes the development of new stochastic model checking techniques and the application thereof to predict dependability and performance properties. Such models are applied, for example, to analyse control networks for critical infrastructures, such as the water and electricity networks.

Whenever possible, within DACS M.Sc. projects are part of bigger projects, facilitating close collaboration between M.Sc. and Ph.D. students. In the past this has resulted into several joint papers by M.Sc. and Ph.D. students, and presentations of these papers by M.Sc. students at international conferences.

Dr. ir. Aiko Pras

4.3 THE DATABASE GROUP (DB)

Our mission is to provide data management to create added value on top of autonomous data sources. Nowadays huge amounts of data are produced by both humans (“prosumers”) and devices connected to the Internet. This has led to information overload and a decrease in the trust of data (lack of quality: inaccuracy, ambiguity, and even inconsistency), as well as an increase of privacy threats. At the same time applications need data of high quality, and a way to deal with privacy sensitivity. Our approach is to extend database systems with data management functionality that filters and computes relevant information out of the data, reduces the unreliability of the data, and protects the privacy.

The core competence of the group is data management. On top of that, individual members of the group have expertise in database technology, information retrieval, security, XML, and streaming data. This combined expertise makes it possible to work on our mission. To address query processing and information retrieval meet. To deal with a lack of trust we work on enriching uncertain data, and finally to deal with privacy threats we work on Security and Privacy.

Search on semi-structured data

With the rise in application of XML technologies, the need arises for management of large collections of XML documents. Our research on querying and searching of semi-structured data aims to extend relational technology for processing XML data. The group primarily addresses XML query optimization and search and ranking. Future work will be on Large-scale distributed search, Social search for communities, and Spatial search.

Enriching uncertain data

Uncertain data can be found in many flavors. Data integration matches schemas and data of different sources, possibly leading to ambiguities and conflicts. Processing multi-media data introduces uncertainty, e.g. by the quality of feature extractors. The same applies for acquired sensor data, e.g. the location of a person acquired by a localization system. The processing, querying, and retrieval of extracted metadata must acknowledge uncertainty in the data. We investigate how to increase certainty by relating uncertain data with additional knowledge from the context, application, and community knowledge, in particular pertaining to context aware systems, location based services, and multimedia retrieval. In the near future we intend to investigate data integration, entity matching/identification/resolution, streaming data processing specification, evolution and provenance, and data quality improvement with user & system feedback.

Security and Privacy

Work is done in the following areas: search in encrypted data, access control and privacy protection. Regarding search in encrypted data, we investigate the problem how personal, sensitive data can be securely stored on a (third party, attractive but) untrustworthy server. Regarding access control, we investigate how secret keys, stored by authorized users and used for cryptographic enforcement of access control mechanisms, can be distributed and managed. In the future we aim to address secure handling of healthcare data, and investigate amongst others key management and distribution in medical applications. Regarding privacy protection, our idea is to subject data to progressive degradation while preserving the intended usability of the data. Progressive degradation is a refinement of limited retention (an “all-or-nothing” approach). We want to show that data degradation is practically feasible.

More information about the Database group can be found at: http://db.cs.utwente.nl

Prof.dr. P.M.G. Apers
4.4 DISTRIBUTED AND EMBEDDED SECURITY (DIES)

Security and protection of privacy in ICT systems becomes more and more important in a world of networked devices that pervade our lives to an ever larger degree. Examples are Industrial Control Systems where computers monitor and control critical processes in factories and plants, modern smartphones that we use continuously update our digital representation in social networks like Facebook, or modern vehicles which are complex networks of dozens of embedded computers that communicate more and more, and also with the external world.

Failing to take security and privacy protection into account in the design, implementation, and evaluation of such systems can have disastrous effects. Loss of personal data and credit cards from online platforms, cyber attacks on companies, or infection of computers by malware are already ubiquitous. Addressing the security and privacy challenges is becoming a top priority in many of these areas and this is what the research and teaching of the Distributed and Embedded Security group (DIES) focus on.

As we work on the analysis, design and evaluation of distributed and embedded systems security, we face the complex, heterogeneous, networked systems that operate in often hostile environments, often under severe resource constraints. Security research spans a broad range, starting from both lowest level of a computer and operating system and from cryptographic and mathematical foundations all the way up to applications, user behaviour, or embedding of our security mechanisms into the real-world environment that these systems operate under.

Applied methodologies also have to reflect this broadness in scope. Mathematical tools, formal modelling and model-based verification form one group of mechanisms that we use in our daily work. They go alongside practical investigations and implementation of functional prototypes. But also the use of complex simulations to evaluate large and complex systems is applied regularly. And then, security research is often also a game of cat and mouse, where attackers will only need to find one weakness in a design to completely break the security of the system. Protecting from attacks thus demands thorough, careful, and robust system design, a skill that is highly appreciated not only in security.

Our teaching also reflects the broad range of topics. We teach basic courses on cryptography, operating systems, and introduction to security at the bachelor level, followed by more specialized master courses, for example on security and privacy of mobile systems or the prevention of cybercrime. We also train students in ethical hacking and offer exciting opportunities for individual research work on the topics described above, for example in the form of a master thesis.

One of the strengths of DIES is that it hosts researchers with a complementary set of expertise that enables us to perform security and privacy research starting from a strong theoretical and mathematical foundation but also covering system-oriented research as well as many specific applications domains like health, wireless sensor networks, social networks, and the automotive and transportation domain. Close ties with other groups that focus on specific aspects like Information Systems, Databases, or Communication Systems complements the picture.

We believe that a close integration of teaching and research is a fundamental principle of a University. Master students working with DIES are therefore often working in the context of bigger projects and also collaborate with PhD students and external partners in such projects. This includes the Dutch police, car manufacturers like Volkswagen or Daimler, and IT companies like NXP. This also offers interesting job perspectives after your studies at UT have ended.

We also have students involved in practical testing of the security mechanisms of the university network or participating in international hacking contests (like the international Capture The Flag contest) where they compete with dozens of other teams around the world.

Students also regularly contribute to scientific papers, maybe creating the first entries to a publication list of a long and successful academic career. No matter whether you see your personal goal in industry or academia, our motivation is to educate the top security specialists that have the necessary skill and knowledge to solve the security and privacy problems of the future.

prof. dr. P.H. Hartel
All human endeavor is imperfect. But software bugs are extremely annoying, costly, or even dangerous. Desktop computers can simply be restarted if they reach a blue screen; buggy tv’s and remote controls can still be collected by their manufacturers. For aviation software, railway controllers, nuclear power plants and medical equipment, failing systems are simply unacceptable. Can we avoid errors at all, or should we tolerate them? What are effective methods to spot errors? Is it possible to prove the absence of error?

Software correctness

The research and education of the Formal Methods and Tools group aims at applying rigorous techniques to improve the quality of software-intensive systems by all means. To avoid errors, requirements specifications and early designs are scrutinized with powerful tools, such as model checkers and theorem provers. On the other side of the development lifecycle, an emerging field is software verification at the level of source code or the generated byte-code. Even further down the line, an effective method to detect bugs is by applying systematic testing techniques. An important goal is to learn which method is most effective in some phase of the software life cycle. Of course this depends on the type of system and the particular aspect that one wants to study, e.g. correctness, security, timing, dependability. For embedded systems, quantitative and hybrid aspects come into play as well.

Theory

There’s nothing more practical than a good theory. The theory behind software verification stems from discrete mathematics and logic. These fields provide us with the reasoning capabilities to prove beyond all doubt that a system is correct, or to establish coverage criteria of test suites. Nasty errors typically arise from interactions between concurrent subsystems. Therefore, concurrency theory is a fundamental background for our research and teaching. Central themes are process algebra, (timed/hybrid) automata, and temporal logics. Also algorithmic game theory provides fundamental insights in interacting systems (players) and environments (the adversary).

Tools

Software verification is really challenging from a computational point of view. The devil is in the details. Our tools should analyze all possible scenarios. However, there are exponentially many! So the tools that we build contain non-trivial data structures (such as binary decision diagrams), complicated algorithms (e.g. symmetry reduction) and clever implementation techniques (incremental hashing). We are also constructing parallel algorithms for clusters of workstations and multi-core machines, to tackle large problem instances by brute-force hardware solutions. It is an engineering challenge to combine all these ingredients effectively!

Interested?

We offer broad courses for students in Software Engineering and Embedded Systems. These are aimed at modeling notations, and the effective usage of verification tools. Become a verification engineer!

For the theoretically inclined, we offer the track MTV, Modeling and Tools for Verification. The specialized courses aim at understanding and extending the theory and algorithms behind the tools, and form an excellent background to become a researcher in this field.

FMT is coordinating the graduate school programme “Dependable and Secure Computing”. We also offer exciting projects for both theoretically and practically oriented students.

Prof.dr. J.C. van de Pol

4.6 HUMAN MEDIA INTERACTION (HMI)

‘COMPUTING POWER AND THE FABRICS OF EVERYDAY LIFE’

“The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it.” This is a famous quotation from a paper called “The Computer for the 21st Century” written by Mark Weiser.

“Computer technology that weaves itself into the fabric of everyday life.” This is also the vision of Prof. Anton Nijholt whose goal is to realize this idea of invisible computing technology. In his view the fabric of future everyday life includes what we now see around us: other people, animals, furniture, clothes, walls, and devices that support us and our children in our daily home, recreational, office, and mobile activities. But in this fabric we will have intelligent sensors that detect what we are doing, share knowledge amongst themselves, and interpret what is going on. In addition to this ‘invisible’
intelligence embedded in the environment we will have human-like robots and also virtual humans displayed in virtual and mixed reality environments that interact with their human partners in human-like ways.

Home and other environments, humanoids, and devices that see, hear, and feel what we are doing will become familiar with us. They will know about our background and history, they will know about our preferences, our moods and emotions, and they will therefore be able to anticipate what we want. Hence, we enter the area of artificial intelligence and of affective and empathic computing. That is, computers embedded in environments, furniture, pets and physical and virtual humanoids that display rational and social intelligence, and that show empathy.

Sensor-equipped environments allow implicit and explicit interaction. We have implicit interaction if the environment understands and anticipates our actions and activities. Anomalies of daily activities can be detected and the environment and its devices may decide to inform or ask the inhabitant about what is going on, it may autonomously take action to repair or recover from a certain situation or it may issue a warning to a monitoring system. Recommender systems may suggest activities or commands based on preferences of inhabitants of smart environments.

Human Media Interaction research is multi-disciplinary research. Traditional computer science research is of course important. We need to design and implement interfaces, whether they are invisible or not. In particular this design should address the issue of ‘natural interaction’ for the human user. That is, we need to look at verbal and nonverbal behavior of humans when they interact with each other, their children, and their pets. We should understand what roles are played by gaze, head orientation, gestures, posture, and verbal interaction and these roles should also be modeled in order to embed similar capabilities into synthesized environments and humanoids. Clearly, as human media interaction researchers, for that we need to cooperate with scientists from behavioral sciences. We need to cooperate with cognitive scientists about mental activities of inhabitants of our future smart environments. And we need to cooperate with (social) psychologists about designing environments and humanoids that can show empathy and that allow the emergence of social relationships between humans and their ‘artificial’ partners.

Prof. dr. ir. A. Nijholt

4.7 INFORMATION SYSTEMS (IS)

"Value creation for organisations requires new information system architectures. Commercial and public organisations no longer view information technology only as a way to save costs in their processes, but also as a resource to create additional value. According to prof. dr. Roel Wieringa, chair of the Information Systems Group, this ‘calls for new architectural designs in the information function of organisations.’"

“This phenomenon started in the 1980s with the advent of EDI networks, accelerated in the 1990s with the proliferation of the Internet, and today is widespread across the globe. This calls for continuous rethinking of business process and information technology effectiveness in value creation. Often these value networks are decentralized, meaning that they consist of equal partners, without a central authority. Information systems therefore need to be designed in accordance with the goals of a disparate set of independent stakeholders. In this context, information systems should support processes within and across organizations that may or may not be fully specified. And at the same time, they should avoid harm to security and privacy of the actors involved. Our mission is to develop methods, concepts, and tools for the efficient and effective design of information systems in decentralized networks, and to provide bachelor- and master-level teaching in these areas. We also take responsibility in transferring the results of our research to society."

“We have three kinds of research projects. In a number of projects we work with companies to develop tools and techniques for value web creation, that is, the creation of networks of profit-and-loss responsible partners. For example, we work with companies in the music business and in the electricity supply business to redesign their value webs, redesign their cooperation processes, and redesign their IT architecture to enable working on a pay-per-use basis. In a second group of projects we develop mobile and context-aware technology that provides improved or value-added services to clients in health care organizations. In a third group of projects we develop information risk assessment tools and techniques for companies that work in a value web, and that need to assess the risks of compromising their information systems. We work with financial companies, organizations in health care, consultancy companies, manufacturing companies and with government organizations. We take care that in our research we follow sound methodological principles, as well as that we produce results that are relevant for society."

Prof.dr. R.J. Wieringa
4.8 THE PERVERSIVE SYSTEMS GROUP (PS)

The Pervasive Systems group investigates a new paradigm for bringing the flexibility of information technology to bear in every aspect of daily life. It foresees that people will be surrounded by embedded and flexibly (wirelessly) networked systems that provide easily accessible yet unobtrusive support for an open-ended range of activities, to enrich daily life and to increase productivity at work.

Sensors are tiny devices capable of capturing physical information, such as heat, light or motion, about an environment. Rapid advances in technology have enabled a new generation of tiny, inexpensive, networked sensors, or Smart Objects. Embedding millions of such smart objects into an environment creates a digital skin or wireless network of sensors, each sensor capable of capturing physical information about its immediate space. These massively distributed networks of smart objects communicate with one another and summarize the immense amounts of low-level information to produce data representative of the overall environment. Such pervasive systems present information in a qualitative, human-interpretable form, which allows the system and the people to respond intelligently. Cooperation is a necessity, to perform their tasks with sufficient quality or efficiency, and to reach the required functionality. The specific nature of these systems require them to be open, scalable, adaptable and dependable, while integrating heterogeneous devices ranging from tiny sensors to larger computers; and support real time interactions. Collaborative smart objects will be an important building block to bridge the gap between the physical and digital world by providing information about aspects of their physical environment.

Current industrial and academic research indicates that pervasive systems might soon become an integral part of our daily lives with applications in economically and societal important areas such as retail, supply chain management, asset management, safety critical situations in work places and healthcare.

While systems of smart objects clearly will need to build on emerging technologies such as RFID and wireless sensor networks, the envisioned ubiquity of smart objects raises important questions about the digital representation of physical artefacts, their cooperation paradigms, their adaptation to the dynamic environment, and the applications that will benefit and influence their design and development.

The supporting architectures should be open, distributed and scalable, naturally integrating heterogeneous devices ranging from tiny actuators to large computers. The research themes are focused on the following topics and their interaction:

- Wireless networked embedded systems, dealing with the networking aspects of pervasive systems, and
- distributed data processing and reasoning, dealing with the processing and interpretation of distributed data.

The common theme in these areas is on the development of large-scale, heterogeneous, wireless, distributed systems. Research questions cover architectures, protocols, programming paradigms, algorithms, and applications. The general research vision we have is that a multidisciplinary approach is necessary as many of the identified challenges need to be addressed in an all-inclusive way that considers systems, environment and users in close correspondence. Therefore, in the research of the group fundamental research activities that address the need for new methods, models, and tools are interwoven with experimental projects.

Prof. dr. P. Havinga

4.9 SOFTWARE ENGINEERING (SE)

‘DESIGNING AND MAINTAINING LARGE AND COMPLEX SOFTWARE SYSTEMS’

Software is everywhere; in your TV, music set, mobile phone, camera, car, banking system, and even in your electrical tooth brush. Software rules the world; nobody can imagine the world without software. Since software is affecting our lives in so many ways, it is important to maintain it at a high level of quality. But software is becoming increasingly large and complex, for instance, millions of lines of code are necessary already for your modern TV. With increasing code size, the structure of software does matter for its survival. You need to know how to build and deal with complex and large software systems in order to ensure correct behavior and to enable the addition of new features in the future.

Thus, the Software Engineering group focuses on Quality-Oriented Software Engineering. Our mission is:

‘To model, implement and optimize software engineering processes for specifying, designing, implementing, verifying and optimizing software artifacts at various abstraction levels for the purpose of fulfilling the stakeholders’ requirements of software systems’.
To ensure a good quality of software, you need to shape it well. All relevant concerns must be separated from each other and their implementation must be as independent as possible, e.g., contained in different files. If you perform this so-called decomposition of your software wrongly, it will become useless sooner than you expected. A good decomposition can make software resilient to downsides of life, able to recover from crashes, run fast, and adaptable to unforeseen conditions.

The Software Engineering group carries out research projects with a number of industrial partners to deal with huge software systems. We investigate means to shape software optimally so that your smart home and web services keep on working as expected. We research means enabling software to recover from crashes so that, for instance, your TV keeps on showing your favorite channel, in real time. To keep, e.g., your printer functioning optimally, we search for methods making software adaptable to changing conditions. We develop methods to realize systems that can smoothly evolve, for example to have shorter times-to-market for new advances in medical equipment.

The Software Engineering group has structured its research activities in complementary and partially overlapping research areas, identified by considering abstraction levels (from programming to architectures), application domains (from embedded to distributed (large-scale) systems), and relevant quality factors and supporting techniques. These areas have also been identified taking into consideration the expertise and interest of the scientific staff, and have allowed the group to acquire national and international projects. The research areas are: Programming Languages, Architecture Design, Service Architectures, Verification and Optimization. The quality factors addressed by the group are, amongst others, compositionality, correctness, dependability, evolvability, traceability, open-endedness and flexibility.

Our master education program in software engineering covers the state-of-the-art topics necessary to design and maintain high quality software systems. Once you graduate, chances are that you will work as a software engineer, like many of our graduates. Every graduate can write some software. No problem with that. But most importantly, do you know how to design and build successful software systems that will have the right balance of the desired qualities?

Prof. dr. ir. Mehmet Aksit
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+) and the Centre for Telematics and Information Technology (CTIT), IMPACT and MIRA.

1.1 Organization chart EEMCS

Dean

Prof.dr.ir. A.J. Mouthaan

Board of Professors

& Programme directors

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 (CSC)
  - Applied Mathematics (AM)
  - Creative Technology (CreaTe)

- Master’s programmes:
  - Applied Mathematics (AM)
  - Computer Science (CSC)
  - Electrical Engineering (EE)
  - Embedded Systems (EMSYS) (3-TU)
  - Human Media Interaction (HMI)
  - Mechatronics (MT)
  - Systems and Control (SC) (3-TU)
  - Telematics (MTE)

Services & units

- Director of Operations
- Ing. H. van Egmond
- Safety and Health Care
- Education Support Office
- Office of the Dean of EEMCS
- Finance
- Information Management
- Division Research
- TCO
- MESA+ Cleanroom lab

Department

- Applied Analysis and Mathematical Physics (AAMP)
- Biomedical and Environmental Sensor Systems (BIOS)
- Biomedical Signals and Systems (BSiS)
- Computer Architecture & Embedded Systems (CAES)
- Control Systems and Dynamic Networks (CSDN)
- Design and Analysis of Communication Systems (DACS)
- Databases (DB)
- Distributed and Embedded Security (DES)
- Discrete Mathematics and Mathematical Programming (DMMP)
- Formal Methods and Tools (FMT)
- Information Systems (IS)
- Integrated Optical MicroSystems (IOMS)
- Information Systems (IS)
- Mathematical Systems and Control Theory (MSCS)
- Numerical Analysis and Computational Mechanics (NACM)
- Nano Electronics (NE)
- Perceptive Systems (PS)
- Power Engineering (PE)
- Semiconductor Components (SC)
- Software Engineering (SE)
- Stochastic Operations Research (SOR)
- Statistics and Probability (SP)
- Structural Systems and Signals (SSt)
- Transducers Science and Technology (TSt)

Education

Bacher
- Electrical Engineering
- Technische Informatica
- Technische Wiskunde
- Creative Technology

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

Programme Committee

Examination Board
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) and MT this is prof.dr. M.C. Elwenspoek (Miko)
For AM (BSc and MSc) and SC this is dr. J.W. Polderman (Jan Willem)
For CSC (BSc and MSc), TEL 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, ing. H. van Egmond.

SAFETY AND HEALTH CARE EEMCS

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<tr>
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<tr>
<td>Coördinator</td>
<td>ing. S. Visser (Sjoerd)</td>
<td>+31 53 489 3153</td>
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<td></td>
<td>ir. F. Houweling (Frans)</td>
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OFFICE OF THE DEAN OF THE FACULTY OF EEMCS (BFD-EEMCS)

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<td>General e-mail address</td>
<td><a href="mailto:BFD_ewi@ewi.utwente.nl">BFD_ewi@ewi.utwente.nl</a></td>
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<td>Dean</td>
<td>prof.dr.ir. A.J. Mouthaan (Ton)</td>
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<td>Director of Operations</td>
<td>ing. H. van Egmond (Harm)</td>
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<td>Faculty secretariat</td>
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<tr>
<td>director of operations and MT</td>
<td>E.C. Bosch-van der Heijden (Els)</td>
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<tr>
<td>dean</td>
<td>L. Tunc-Katalanc (Lena)</td>
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</tr>
<tr>
<td></td>
<td>E. ter Brugge (Ellen)</td>
<td>+31 53 489 4603</td>
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EDUCATION SUPPORT OFFICE EEMCS (BOB-EEMCS)

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<tr>
<td>Manager of Education</td>
<td>H.J. van Laar (Jolanda)</td>
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</tr>
<tr>
<td>Internationalization</td>
<td>drs. J. Schut (Jan)</td>
<td>+31 53 489 4350</td>
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<tr>
<td>Traineeship</td>
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<tr>
<td>Traineeship coordinator</td>
<td>dr. M.J. Korsten (Maarten)</td>
<td>+31 53 489 3887</td>
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<tr>
<td>Traineeship mediator</td>
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<td>+31 53 489 3887</td>
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<tr>
<td>Student advisers</td>
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</table>
| Computer Science and Applied Mathematics | S.B.A.M. Vonk (Sharon) / L. Spijker (Lilian) | +31 53 489 5645 />
| Creative Technology and Electrical Engineering | T.H. de Klijver (Thea) | +31 53 489 3697 |
| Secretariat        |                             |              |
| Student advisers, Internationalization | R. Assink (Remke) | +31 53 489 3426 |
| Quality assurance  | drs. J.H. Romkema (Hans)    | +31 53 489 2774 |
| Quality assurance  | A. de Bruin-van Willigen (Annemieke) | +31 53 489 3725 |
| Programme directors | K. Veldhuis (Karim)         | +31 53 489 5450 |

COMMUNICATIONS

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

<table>
<thead>
<tr>
<th>Position</th>
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<tr>
<td>Account manager/ communications adviser</td>
<td>t.b.a.</td>
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<tr>
<td>Communications staff member</td>
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PREMISES MANAGEMENT

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<tr>
<td>Premises Manager</td>
<td>ir. M.J.B. ten Bulte (Michel)</td>
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<td>+31 54 489 2299</td>
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LIBRARY & ARCHIVE

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

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<th>Position</th>
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<tr>
<td>Computer Science, Applied Mathematics</td>
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<td>Electrical Engineering</td>
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</tr>
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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 flexoffice of Smart XP. The Creative Technology practicals take place in the Zilverling building on floor 2 (room 3042). Furthermore, in the Zilverling building rooms are situated on floor 3 (3042) and floor 4 (4054) containing 24 and 36 PCs respectively. During lecture hours a room assistant is present in room 3042. 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 near the course rooms in the Zilverling building staff rooms are situated. So please keep quiet in the building, do not use your phone in the corridors but, for example, go to the stairwell or the Educafe instead, and limit talking in the corridors. Eating is prohibited in the PC-rooms; drinking is allowed, using lockable bottles.

Year room
For first-year Bachelor students of Applied Mathematics a year room is available in the Citadel building (T100); most of their training will take place there.

In the Citadel building, there is also a year room available for the Creative Technology programme (T300). Outside lecture hours this room can be used for self-study or as a project space by Create students.

Smart XP Lab
This new multifunctional area in the Zilverling building is structurally used for teaching in 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 brand-new student association
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

for the Bachelor’s programme CreaTe, Proto, has its own association’s room in Zilverling/Hal A.

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.
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.

If you wish to be sure of your enrolment as from 1 September, you must complete all enrolment formalities in time – preferably 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.

2.3 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:

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

2.4 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
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. 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.

If you have any questions on Blackboard or OSIRIS, within the faculty you can turn to S&O, Diane Muller, the Zilverling building, room A104, phone +31 53 489 2681.

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

Educational websites

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

<table>
<thead>
<tr>
<th>Programme</th>
<th>website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creative Technology</td>
<td><a href="http://www.utwente.nl/create">www.utwente.nl/create</a></td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td><a href="http://www.utwente.nl/el">www.utwente.nl/el</a></td>
</tr>
<tr>
<td>Computer Science</td>
<td><a href="http://www.utwente.nl/inf">www.utwente.nl/inf</a></td>
</tr>
<tr>
<td>Applied Mathematics</td>
<td><a href="http://www.utwente.nl/tw">www.utwente.nl/tw</a></td>
</tr>
</tbody>
</table>

For the Master’s programmes:

<table>
<thead>
<tr>
<th>Programme</th>
<th>website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied Mathematics</td>
<td><a href="http://www.utwente.nl/am">www.utwente.nl/am</a></td>
</tr>
<tr>
<td>Computer Science</td>
<td><a href="http://www.utwente.nl/cc">www.utwente.nl/cc</a></td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td><a href="http://www.utwente.nl/eel">www.utwente.nl/eel</a></td>
</tr>
</tbody>
</table>

OSIRIS (Student information system)

OSIRIS is the new self-service student information system which has recently been put into use by 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/onderwijsystemen/en.

If you have any questions, you can turn to Student Services (Vrijhof building), studentservices@utwente.nl, phone number +31 53 489 2124.
enrolment the CSA requires a digital photograph. On workdays between 09.00 and 17.00h you can have your picture taken at the Student Services desk in the Vrijhof building (room 239B), across the library.

2.6 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 (5 September 2011) until week 45 (11 November 2011)
- Quarter 2 from week 46 (14 November 2011) until week 05 (3 February 2012)
- Quarter 3 from week 06 (6 February 2012) until week 16 (20 April 2012)
- Quarter 4 from week 17 (23 April 2012) until week 27 (06 July 2012)

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

For a brief summary in English:
www.utwente.nl/so/roosterwerkgroep/jaarcirkels/jaarcirkels.doc/summary_in_english.html

2.7 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 |

You can also find an overview of all programme guides, OERs etc. on www.utwente.nl/ewi/en/education.
### Jaarcirkel 2011-2012, definitieve versie, eerste en tweede semester

| weeknummer | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 1 | 2 | 3 | 4 | 5 |
|------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| aantal weken |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  
| maandag |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  
| dinsdag |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  
| woensdag |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  
| donderdag |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  
| vrijdag |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  
| zaterdag |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  
| zondag |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  

| weeknummer | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
|------------|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| aantal weken |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| maandag |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  
| dinsdag |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  
| woensdag |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  
| donderdag |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  
| vrijdag |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  
| zaterdag |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  
| zondag |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  

### 2.11 PC-privé schema voor UT-studenten en PC, laptop en printer aankoop

As a student you are entitled to take part in a special subsidized PC purchase scheme referred to as the PC-privé scheme offered by the UT. You can take part in this scheme freely with an interest-free subscription. Every regular full-time student enrolled at the UT can take part in the PC-privé scheme as follows.

#### 2.10 Study material

**Z1** Zilvering

**Z2** Waal

**Z3** Vrijer

**Z4** St. Pieters

**Z5** Sportcentrum

**Z6** Raspoort

**Z7** Lunteren

**Z8** Hoogeveen

**Z9** Horstweg

**Z10** Hoogeveen (location servicedesk c arré)

**Z11** Zilverling

**Z12** UnionShop. You can check the website to see if they are in stock: www.studentunion.utwente.nl/en/.

### 2.9 Knowing your way on campus

All of the faculty of EMCS teaching takes place in rows situated in buildings which are spread all over the campus. In the timetable the lecture rooms are indicated using codes which refer to the buildings. 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 Zilvering rooms.

<table>
<thead>
<tr>
<th>Code</th>
<th>Building</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZL</td>
<td>Zilverling</td>
</tr>
<tr>
<td>WA</td>
<td>Waal</td>
</tr>
<tr>
<td>VR</td>
<td>Vrijer</td>
</tr>
<tr>
<td>SP</td>
<td>St. Pieters</td>
</tr>
<tr>
<td>SC</td>
<td>Sportcentrum</td>
</tr>
<tr>
<td>RA</td>
<td>Raspoort</td>
</tr>
<tr>
<td>LA</td>
<td>Lunteren</td>
</tr>
<tr>
<td>HT</td>
<td>Hoogeveen</td>
</tr>
<tr>
<td>HR</td>
<td>Hoogeveen (location servicedesk c arré)</td>
</tr>
<tr>
<td>HB</td>
<td>Hoogeveen (location servicedesk c arré)</td>
</tr>
<tr>
<td>HI</td>
<td>B-interactie Zilvering Centre and students' location servicedesk C are formed.</td>
</tr>
</tbody>
</table>

All students, staff and guests of the UT are entitled to an account. The ICTS will provide you with a user name and password.
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 PC and communication equipment in the IT shop at a highly competitive price. The University of Twente will lend you a maximum of EUR 1,362.- interest-free, which is to be repaid in a number of monthly instalments.

Whether the student is required to repay the loan in 12 or up to 24 months depends on the remaining duration of the course. If the remaining study duration is 12 months, the loan has to be repaid in 12 months. A graduated calculation related to the remaining duration of the course may mean that the repayment term is longer.

Via the Notebook Service Centre general UT software (such as Maple, Virusscanner, SPSS) can be downloaded. 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/

2.12 Examinations

At the start of the academic year, for every student a timetable of teaching activities and examinations is available on paper. This timetable shows, among other things, the weeks in which examination are held (see also section 2.5). The timetables for teaching are also available on the websites of the programmes.

Any changes, such as, for instance, the examination dates, will be announced via the Blackboard sites of the courses concerned and through Education Announcements. So no new timetables will be distributed among the students every time any changes might occur.
For the sake of students’ and teachers’ clarity the starting time of written examinations is identical to
the first morning or afternoon lecture respectively. So:

- morning examinations start at 08.45h or 10.45h
- afternoon examinations start at 13.45h or 15.45h

Timetables of examinations are available via: http://my.utwente.nl/.

General rules
1. The student himself is responsible for registering or deregistering for the examinations.
2. Twice a year students are given the opportunity to take written and oral examinations belonging to
a particular educational unit. Practical training can be completed at least once a year. The rules that
apply for practical training will be communicated at the start of the educational unit.
3. The student who has not gained a mark 6 or higher after two markings by an educational unit and
who still wishes to gain such a mark, is to appeal to the examination board for permission to take
another examination in the educational unit concerned. This appeal must be accompanied by a
working plan drawn up by the student in consultation with the examiner of the educational unit
concerned and the study advisor. The examination board will decide on the appeal.
4. On the authority of the examination board at least one month before the start of the semester
the timetable of examination of that semester will be announced, in which dates and times of the
examinations are fixed.
5. The examination board may give permission to deviate from the number of times an examination
will be held and the way in which examinations can be taken.
6. Rescheduling an examination to a time different from the one indicated in the timetable is only
permitted after the examination board’s consent.

‘Third Chance’ rules
- You are responsible yourself for this process. Even if late results, schedules, dates of examination
meetings and the like cause a difficult time schedule
- You will have to be able to make a reasonable case yourself for having exerted yourself for the
subject if you want to be considered for tutoring.
- Change of subject code, change of name etc. are irrelevant. It is the identity of the subject that
counts.
- It is advisable to be meticulous about the two attempts you have.
- For a next examination attempt (4, 5 etc.) you always contact the study adviser.
- You have to submit a request for a third attempt per subject, so do not include more than one
subject in a request.
- The examination board may include in its consideration the fact that you are submitting/have
submitted requests for more than one subject.
- This regulation concerns written examinations, and possibly oral examinations as well. For
projects, practicals, other rules apply.
- It is compulsory to register for examinations via OSIRIS. You may deregister until 24 hours before
the examination. If you have not deregistered, the registration will count as an attempt. It is
prohibited to make the examination without registering.
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 IBG (Informatie Beheer Groep, 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.

3.2 Transitional arrangements
If courses are radically changed or if they are cancelled, at the beginning of the academic year you will be informed in writing about the consequences which this entails.

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.

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/stan
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 SRO/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

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 Educational Affairs Office EEMCS

The Educational Affairs Office (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 ground floor of the Zilverling building, room A104-A116. 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!

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/msc/

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 from 11.30 until 16.30h on Saturdays (for study purposes only, during examination periods). 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
4.5  Student restaurant

In the Waaijer 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

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.

Student associations

Every educational programme has its student 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-togethers and parties. In addition, the student association for instance takes care of the book sale.

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

Student participation and other committees

Within the faculty of EEMCS you may become a member of various committees, such as:

The Faculty Council

See also page 1 of this appendix.

Programme Committee

Support Committee for Programme quality
Although every effort has been made to ensure that all the information presented is correct, information in this study guide is subject to changes. No rights may be derived from the information in this guide. For up-to-date information refer to: www.utwente.nl/ewi/en/education