ECTS

European **C**redit **T**ransfer **S**ystem

SOCRATES / ERASMUS

INFORMATION PACKAGE

Department of
Electrical Engineering and
Information Technology

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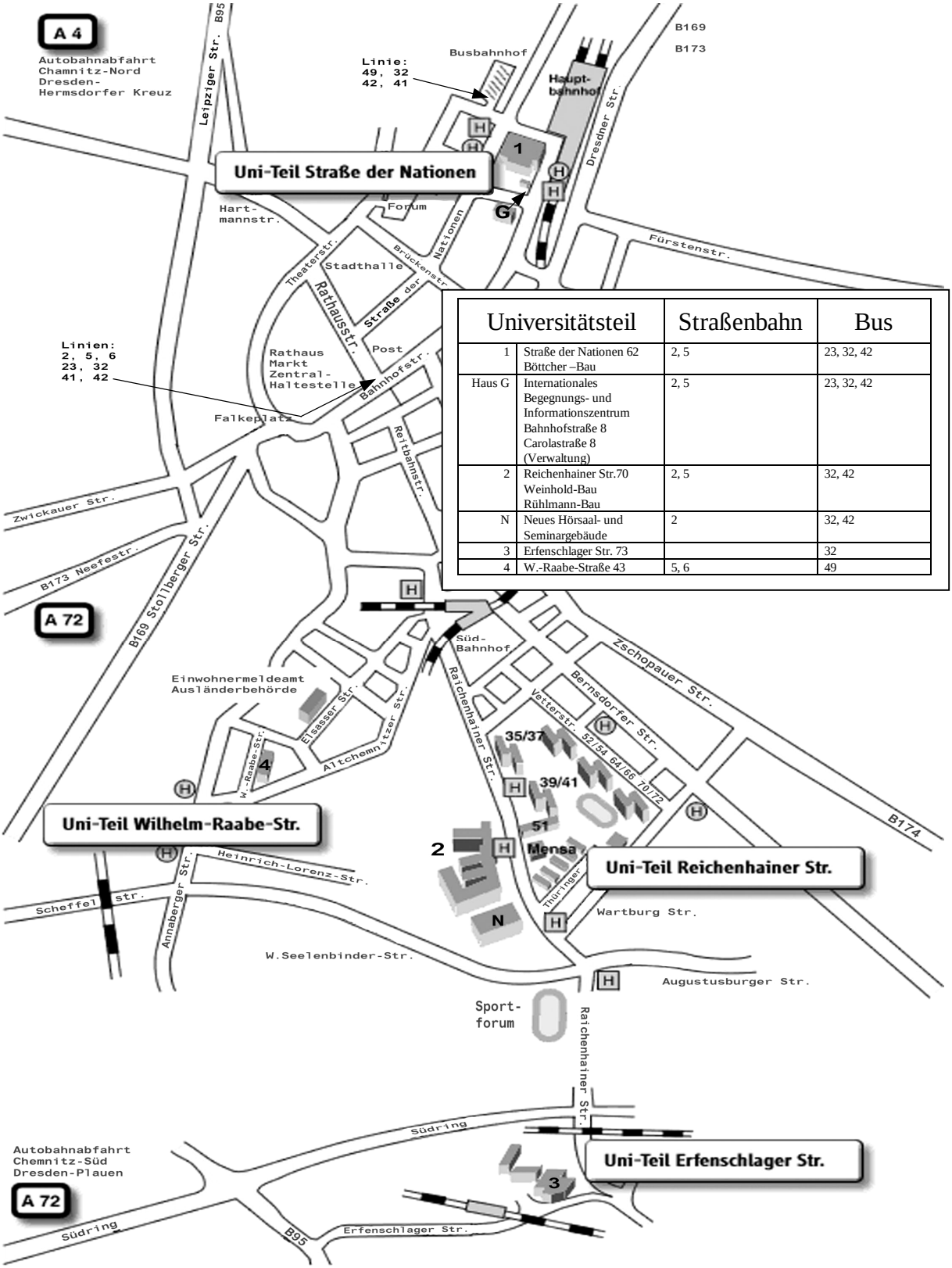
City map of Chemnitz



Universitätsteil		Straßenbahn	Bus
1	Straße der Nationen 62 Böttcher –Bau	2, 5	23, 32, 42
Haus G	Internationales Begegnungs- und Informationszentrum Bahnhofstraße 8 Carolastraße 8 (Verwaltung)	2, 5	23, 32, 42
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PART II

I. GENERAL INTRODUCTION

ECTS and the "Technische Universität Chemnitz"

This information package describes the Chemnitz University of Technology and the courses offered by its Department of Electrical Engineering & Information Technology in order to help the prospective ECTS student to prepare for his/her study period in this institution.

A. What is ECTS ?

ECTS, the **E**uropean Community Courses **C**redit **T**ransfer **S**ystem, was founded by the Commission of the European Community in order to provide common procedures to guarantee academic recognition of studies abroad. It provides a way of measuring and comparing learning achievements, and transferring them from one institution to another.

The ECTS system is based on the principle of mutual trust and confidence between the participating higher education institutions. The few rules of ECTS, concerning Information (on courses available), Agreement (between the home and host institutions) and the use of Credit Points (to indicate student workload) are set out to reinforce this mutual trust and confidence. Each ECTS department provides information about the courses it offers not only in terms of content but also by assigning credits to each course.

B. The ECTS Credits

ECTS credits are a numerical value allocated to course units to measure the student workload required to complete them. They reflect the quantity of work which each course unit requires in relation to the total quantity of work necessary to complete a full year of academic study at the institution. This includes lectures, practical work, tutorials, field work, private work - in the library or at home - and examinations or other assessment activities. ECTS credits reflect a relative value of student workload.

In ECTS, 60 credits represent the workload of an academic year of study and usually 30 credits are given for a semester (6 months). It is important that no special courses are set up for ECTS purposes, but that all ECTS courses are mainstream courses of the participating institutions, as followed by home students under normal regulations.

It is up to the participating institutions to subdivide the credits for the different courses. Laboratory work and optional courses which form an integral part of the course of study also count as academic credit. Laboratory sessions and optional courses which do not form an integral part of the course of study do not count as academic credit. Courses which are not officially assigned credits can still be included in the student's transcript of records.

Credits are awarded only if the courses have been completed and all required examinations have been successfully taken.

C. ECTS Students

Students participating in ECTS will receive full credits for all academic work successfully carried out at any of the ECTS partner institutions. They will be able to transfer these academic credits from one participating institution to another on the basis of prior agreement on the content of study programmes abroad between the institutions involved.

All students of the participating departments who would like to take part in the ECTS may do so if their institution agrees.
Most students participating in the ECTS will study at one host institution in an EC Member State or EFTA country, for a limited period and then return to their home institution. Some may decide to stay at the host institution and finish their degree there. Some may also decide to proceed to a third institution to continue their studies. In each case, students are required to comply with the legal and institutional requirements of the country and institution from which they graduate.

When students return after having successfully completed the study components agreed upon in advance by the home and host institutions, credit transfer takes place. Students may then resume their study program at the home institution without any loss of time or credit.

If, on the other hand, students decide to stay at the host institution and take their degree there, they may have to adapt their study program to comply with the rules of the host country, institution and department.

D. Participating Institutions

The following universities are our partners in frame of the SOCRATES / ERASMUS program in the special field of Electrical Engineering.

A	Johannes Kepler Universität (Linz)
B	Katholieke Universiteit Leuven / IMEC
BG	Bourgas Free University (Bourgas)
CZ	Západoceská Univerzita v Plnzni (Pilsen)
DK	Danmarks Tekniske Hojskole Lyngby
F	Institut des Sciences de la Matiere et du Rayonnement (ISMRA), Caen Universite de Rennes I
PL	Politechnika Lódzka (Lodz)
RO	Universitatea „Politehnica“ Timisoara
S	KTH – Kungl. Tekniska Högskolan (Royal Institute of Technology Stockholm)
SF	University of Oulu

II. GENERAL INFORMATION ABOUT THE UNIVERSITY

A. Institution

Chemnitz **U**niversity of **T**echnology (**CUT**) - *Technische Universität Chemnitz (TUC)/ Germany*

- Straße der Nationen 62 phone : + 49 (371) 531-0 fax : + 49 (371) 531-1684
D - 09107 Chemnitz **Internet : http//www.tu-chemnitz.de**

Note: There is a campus map at the beginning of this package, which provides more information about parts of the university.

B. Admission - Academic Year

Students who want to study at the Chemnitz University of Technology within the framework of the ECTS program should contact the ECTS coordinator of their home university.
Application forms can be ordered by either the TU Chemnitz ECTS coordinator or the International Office. Applicants must have their forms filed by the beginning of the semester.
The academic year is consist of the winter semester and the summer semester. The winter semester begins in October and ends in March. The summer semester begins in April and ends in September. Each semester includes a 15 weeks course period and a 3 weeks examination period. In addition, several weeks are intended for scientific work.

C. Reception - Registration

Upon arrival, the following institutions should be contacted :

1. International Office - "**I**nternationales **U**niversitäts-**K**olleg"- **IUK** - (registration / foreign student office)

2. Student Service Office - "Studentensekretariat" - (Registrar's office)

3. Resident Registration Office - „Einwohnermeldeamt"/
Foreigners Registration Office - "Ausländerbehörde" - (Alien registration authority)

4. ECTS Coordinators

1. International Student Office

The "Internationales Universitätskolleg" (IUK) is the International Office of CUT. It functions as a service point for international students and graduates. The office assists you in social and cultural difficulties, study-related problems and financial questions. Furthermore, it offers course programmes and study trips. Our staff members Mrs Auerbach and Ms Walther are responsible for the guidance and counselling of international students at CUT and are prepared to help you wherever they can. They are supported by student tutors and the members of the IUK Buddy Student Scheme. On their arrival in Chemnitz, all international students automatically become members of the IUK.

- Straße der Nationen 62 / Raum 039 phone: (+49) (371) 531-1302
D-09111 Chemnitz fax: (+49) (371) 531-1868
- contact : Frau Eva Auerbach/ Frau Susan Walther
- www.tu-chemnitz.de/international

2. Student Service Office

- Straße der Nationen 62 / Raum 046
  D-09107 Chemnitz
- office hours :

phone: (+49) (371) 531-18 40, -16 37, -16 90
fax: (+49) (371) 531-18 09
Mon-Wed from 8.30 to 11.00 a.m. & from 12.30 to 3 p.m., Thurs from 12.30 to 5 p.m., Fri from 8.30 to 11

Here you will receive your student identity card.

3. Resident Registration Office

- Elsasser Straße 8
  D-09120 Chemnitz

All students have to register with the police. Documents required are identity papers or passport and a tenancy agreement.

Foreigners Office: Registering with the civil authorities

- Elsasser Strasse 8
  D-09120 Chemnitz
- office hours:

phone: (0371) 4 88 32 43
Mon., Tue., Wed., Fri. from 8.30 a.m. to noon / Thurs. from 2 to 6 p.m.

If you plan to study and live in Germany longer than three months, you must apply at the Chemnitz "Ausländerbehörde" (the Foreigner's Registration Office) for a residence permit. Beforehand, you must report to the "Einwohnermeldeamt" (Residence Registration Office). You are required to register at the "Einwohnermeldeamt" within two weeks of your arrival.
At the "Einwohnermeldeamt" (Residents Registration Office) you will be asked to present your passport. After the process is completed you will receive a paper which confirms that you have registered.
A residence permit (€ 40) is usually issued for one year and has to be renewed well in advance of the expiry date (€ 20).
The official at the "Ausländerbehörde" (the Foreigner's Registration Office) will ask to see the following documents:

- Passport
- passport-sized photographs
- CUT matriculation certification
- Application form, completed
- Proof that you have registered at the "Einwohnermeldeamt" (Residents Registration Office)
- Proof of financial resources

Visa Requirements

If you are an EU national, you do not need a visa for your stay in Germany. If your home country is not a member state of the EU, however, you will have to apply for a visa for study purposes well in advance of your entry to Germany. To obtain your visa you are advised to contact Germany's foreign representation (embassy or consulate) in your native country as soon as you have received your letter of admission from Chemnitz University. As the processing of your application may take several months it is important that you get in touch with the German embassy or consulate no later than 4 months prior to your planned arrival in Germany. In addition to your letter of admission, you will be required to present some proof of financial resources at the foreign representation (details below). Furthermore, you will need

- a passport valid for the whole period of your stay in Germany
- filled in RK 1200 application form
- passport-sized photographs

Please note that prospective international students from countries where a visa must be issued before entering Germany are on no account allowed to enter as a tourist and stay on to study. A tourist visa cannot be converted into a student visa once you are in Germany, not even at an embassy or consulate in Germany's neighbouring countries.

Proof of Financial Resources

In order to obtain a visa for entry to Germany and to register with the German authorities once you are here, you are required to prove that your financial resources are sufficient to cover the cost of study and living expenses for the entire period of your study visit (currently amounting to approx. € 500 per month). What suffices as proof of financial resources will be specified by the German embassy or consulate in your native country.

As an exchange student, e.g. in the SOCRATES/ERASMUS program you will have to prove a scholarship, including the amount and duration.

4. ECTS Coordinators

The institutional ECTS coordinator is : **Prof. Dr. Rainhart Lang, phone. 531 4152, r.lang@wirtschaftl.tu-chemnitz.de**

In addition, each department has its own ECTS coordinator. The student may contact the adviser for information about courses, timetables, student organizations, etc.

The ECTS coordinators and contact persons are :

- Department of Electrical Engineering and Information Technology :
  Prof. Thomas Gessner
  Reichenhainer Str.70; Raum 341
  phone (0371) 531-3130
  fax (0371) 531-3131
  Dr. Wolfgang Seckel
  Reichenhainer Str.70; Raum 339
  phone. (0371) 531-3261
  fax (0371) 531-3131
  email: wolfgang.seckel@zfm.tu-chemnitz.de

- Department of Computer Science :
  Prof. Hanno Lefmann
  Str. der Nationen 62; Raum 347
  phone (0371) 531-1276
  email: lefmann@informatik.tu-chemnitz.de

- Department of Economics and Business Administration :
  Prof. Rainhart Lang
  Reichenhainer Str.39; Raum 613
  phone (0371) 531-4152
  email: r.lang@wirtschaftl.tu-chemnitz.de

- Department of Mathematics :
  Dr. Jürgen Schulz
  Reichenhainer Str.41 , Raum 708
  phone (0371) 531-4107
  email: j.schulz@mathematik.tu-chemnitz.de

- Department of Mechanical Engineering and Process Technology :
  Prof. Michael Dietzsch
  Reichenhainer Str. 70; Raum A7
  phone (0371) 531-2202
  email: michael.dietzsch@mb2.tu-chemnitz.de

- Department of Natural Science :
  Dr. Eckart Fromm
  Reichenhainer Str.70; Raum 360
  phone (0371) 531-3207
  email: fromm@physik.tu-chemnitz.de

- Humanities Department :
  Prof. Matthias Niedobitek
  Reichenhainer Str.39; Raum 305
  phone (0371) 531-4912
  email: matthias.niedobitek@phil.tu-chemnitz.de

The persons listed above meet with student representatives and with representatives of the involved University services (International Office - Student Affairs - Student Services - Student secretariat - Rector's office) in order to discuss proposals for the University's ECTS policy.

D. Student Administration (Studentenwerk Chemnitz)

1. Accommodation / Housing

The Studentenwerk Chemnitz (Chemnitz Student Administration) is in charge of the social and cultural well-being of all students.

Thüringer Weg 3 , D - 09126 Chemnitz
phone : (0371) 5628-0 - fax.: (0371) 56 28-102
office hours : Mon-Thurs 7.30-11 a.m. und noon-3 p.m.

International students can apply for a single room or a bed in a double room in one of these residences. The prices depend on the furnishings of the room and vary between €90 and €190 per month. Before signing the lease contract, a deposit of approx. twice the monthly rent has to be paid on the room.
All student residences are connected to the internet and for an annual fee of €10 students can go online with their own PCs.
For further information about student accommodation on campus please contact Mr Pässler, head of the accommodation service:

phone: (+ 49) (371) 562 8829
e-mail: dirk.paessler.info@swcz.smwk.sachsen.de

If exchange students would like to live in residence during their stay, they are asked to tick the respective box on the CUT application form. The staff of the IUK will then make a reservation for them. Note, however, that we cannot fully guarantee accommodation in any one of the residences.
We strongly recommend you to bring your own bed sheets, otherwise you will have to rent a set for a fee of €6. Contact: Mr Postel, Vettersstraße 52, 09126 Chemnitz, phone: (+49) (371) 5628 352.
In case it is not possible for you to move into one of the residences on the day of your arrival, you may wish to contact the Chemnitz youth hostel and stay there for the first couple of nights.

Details: **Augustusburger Straße 369, 09127 Chemnitz**

From the Chemnitz train station you can get there by bus or tram (curfew 10 pm):
Tram # 5 ("Gablenz") until 8 pm, get off at "Pappelhain" stop, follow the signposts to the hostel, the walk takes about 20min.
After 8 pm – take any bus or tram from the train station into town, get off at the central stop ("Zentralhaltestelle") and take tram # 11 ("Gablenz"). Get off at "Pappelhain" and follow the signposts to the hostel.

Until 5 pm you can also take the bus "Chemnitz-Augustusburg" and get off at the "Walter Klippel Straße" stop, right in front of the hostel.

phone: (+49) (371) 713 31
fax: (+49) (371) 733 31
email: jhchemnitz@djh-sachsen.de

Private Sector Accommodation
If you do not wish to live in one of the student residences, but would like to find private accommodation, the following web page might be of interest to you: **www.tu-chemnitz.de/stuwe/**

Private sector accommodation is relatively easy to find in Chemnitz as there are a number of options available. There are plenty of shared flats (WGs – Wohngemeinschaften) close to the university and rooms usually cost from € 120 - € 300.

2. Catering / Meals

All University residences are self-catering. A good and inexpensive lunch can be taken in one of three refectories (Mensa). A choice of four meals is provided, in addition to numerous, delicious salads and desserts. Prices for a meal vary between € 1.30 and € 2.

- Mensa Reichenhainer Str. 55
- Mensa Straße der Nationen 62

3. Cost of living

CUT does not charge any tuition fees. However as a student you will have to cover the costs of living, teaching materials and books yourself.
You should calculate at least € 500 a month to cover all costs. Because of the legal status of non-German citizens, it is usually not possible for international students to finance their studies by working. Holders of a visa are allowed to work for only 90 days a year. Exceptions of this rule are only granted students who work as student workers at the CUT.

E. Study Facilities

1. Libraries

The library is divided into the central Library, several smaller branches, a patent information-centre, and a collection of standardizations. It provides books, journals, audio-visual materials, and electronic information services. The computer and catalogue system of the library facilitates the quick and easy retrieval of information on requested books.

- Central Library (University) / Chemistry Strasse der Nationen (entrance Bahnhofstr.)
opening hours : Mon. - Thurs. : from 9 a.m. to 6 p.m. / Fri. : from 9 a.m. to 4 p.m.
Sat. : from 10 a.m. to noon

Branch Libraries (TB) :

- Economics /Business Studies/ Jurisdiction Reichenhainer Str.39 (4th floor)
opening hours : Mon. - Thurs. : from 9 a.m. to 9 p.m. / Fri. : from 9 a.m. to 6 p.m.
Sat. : from 10 a.m. to 1 p.m.

- Humanities / Mathematics Reichenhainer Str.29a, Pegasus-Business-Ctr.
opening hours : Mon. - Thurs. : from 9 a.m. to 9 p.m. / Fri. : from 9 a.m. to 6 p.m.
Sat. : from 10 a.m. to 1 p.m.

- Electr. / Mechan. Engineering and Physics / Natural Sc. ReichenhainerStr.70 / Weinhold-Bau
opening hours : Mon. - Thurs. : from 9 a.m. to 9 p.m. / Fri. : from 9 a.m. to 6 p.m.
Sat. : from 10 a.m. to 1 p.m.

Patent Information Center Bahnhofstr.8
(Internationales Begegnungs- und Informationszentrum)

2. Computer Facilities

Director : **Prof. Dr. Uwe Hübner**
Str. der Nationen 62; Room 308b
phone (0371) 531-1464 /
fax (0371) 531-1629

The University Computer Network *(**U**niversitäts**r**echen**z**entrum - **URZ**)* is a central, scientific facility at the TU Chemnitz. It connects the on-campus network with national and world-wide communication webs, effectively catering to the university's technical demands. The computer rooms have developed into a leading facility providing consulting and services for users of today's modern data processing systems. Student rooms can be connected to the Internet. Students can also use the facilities of the University computer rooms. Furthermore, there are possibilities to take tuition-free computer classes.

The User Services (URZ) offer:

- Advice to all services of the URZ
- Issuing and extension of user IDs
- Registration for Computer Courses
- Issuing of email-addresses

F. Leisure Activities

1. Sports

The university sport centre offers a wide range of indoor and outdoor sports, including: karate, alpine sports, hiking, climbing, paragliding, tennis, swimming, dancing, volleyball and many more. The complete program can be reviewed in the dining halls at the beginning of each semester .
To receive information, please contact :

Sportbüro der USG Chemnitz e.V.	phone: (0371) 531-2073	- Thüringer Weg 11
Universitätssportzentrum	phone: (0371) 531-2430	- Thüringer Weg 11
		- 09126 Chemnitz

2. Clubs

The various students clubs are a good possibility to meet new people, talk to other students, listen to music, or just relax. They are managed by students, who regularly organize movie evenings, slide shows, and dancing events.

- **FPM-club** and **B612**
- The **Bierkeller** : Reichenhainer St. 51;
- **PEB-Club**, **Film club ´mittendrin´, bit-boutique** and **Agfielvalt** : Vettersstraße 64/66;
- **WIWI-club** : Vettersstraße 70/72.

In addition, there are many pubs, restaurants, and café's with a friendly atmosphere located in town.

3. Associations

The English Club
Email: englishclub@tu-chemnitz.de
www.tu-chemnitz.de/stud/club/english
Arabic-Club
Email: andreas.fischer@physik.tu-chemnitz.de
www.tu-chemnitz.de/stud/club/arabisch
Australian Studies Group
Email: australien@phil.tu-chemnitz.de
www.tu-chemnitz.de/stud/club/australien
Chinese-German Club
Email: chinesisch-club@tu-chemnitz.de
www.tu-chemnitz.de/stud/club/chinesisch
Club des Francophones
www.tu-chemnitz.de/phil/romanistik/club/
Finnischer Club
Email: v.uski@physik.tu-chemnitz.de
Group of students from Romania
Email: radu.bot@mathematik.tu-chemnitz.de
Group of students from Czech Republic
Email: ludek.hodic@s2000.tu-chemnitz.de
Russian Club
Email: viktor.ehli@gmx.net

- **VDE**: Verband Deutscher Elektrotechniker Bezirksverein Chemnitz (Union of German Electrical Engineers of the District of Chemnitz) The members of VDE are engineers, (natural) scientists, technicians, major companies of the electronics and power industry, high-technology, firms, as well as numerous institutions of research.
  http://www.tu-chemnitz.de/VDE
- **VDI** : Verein Deutscher Ingenieure - (Association of German Engineers): The VDI was founded in 1856. With 120,000 members, it is one of the biggest technical and scientific association in Europe for students and young engineers, today. Among other things, it represents the interests of engineering profession and association.
- **AIESEC** : Association Internationale des Etudiants en Sciences Economiques et Commerciales (International Association of Economics and Marketing Students) Reichenhainer Str. 41; Room 04 / Tue. 12.30 - 13.30 p.m. / Thu. 10.00 - 11.30 a. m. This international association, with more than 70,000 members in 85 countries, provides opportunities for exposure and interaction between young people of different cultures and nations worldwide; it assists young people in acquiring skills and knowledge through management education and practical experience, and it offers the opportunity to interact with their social and economic environment.

- **IAESTE** : International Association for the Exchange of Students for Technical Experience

- **MTP** : Die Marketing - Studenteninitiative - (The marketing initiative of students) TU Chemnitz - Reichenhainer Str.39; Room 101.MTP is a initiative with more than 600 members and 14 agencies throughout Germany. The abbreviation MTP means **M**arketing between **T**heory and **P**ractice. At the moment, there are 16 members at the agency of Chemnitz.
- **MUKU** : Multikulturelle Studentengemeinschaft - (Multicultural Student Community) TU Chemnitz - Vetterstr. 52/54, 6th floor. In this community foreign students will find help if they have any problems. It gives students a strong support in integrating themselves in the new University life. The MUKU organizes several cultural and sporting events.

4. Cultural Activities

Chemnitz offers a wide range of cultural facilities such as theatre performances, cabarets, operas, galleries and museums. Programs are available at the theatre service.
phone : (0371) 488-46 65

5. Churches

On campus, several rooms have been reserved for weekly religious meetings of students of the Protestant and Catholic community. More information is posted on the board in the dining hall (Mensa) on Reichenhainer Str. 55.

G. Linguistic Requirements - Language Courses

As an exchange student you are exempted from the DSH examination (German language examination for the access to higher education). However, you will be able to take German language courses running throughout the term at the CUT Language Centre. Foreign students are welcome to attend the International Summer Course held, in August. For further information, please contact at the University :

www.tu-chemnitz.de/phil/germanistik/daf/sommerkurs

Intensive Pre-sessional German Language Course
Twice a year we offer a three-week German language crash course especially for exchange students. These courses are held before the new semester starts, usually beginning in the second week of September or March, respectively. According to their language skills, participants are streamed into courses at the beginners, intermediate and advanced levels. In addition to conventional language classes, all courses include excursions in and around the city of Chemnitz. Usually, there will be one day-excursion per week and four days of language tuition with 6 hours of in-class teaching per day (total: 72 lessons). All courses are held by experienced GFL-teachers (German as a Foreign Language).
To apply for the course, please fill in the form in this brochure, or download it from

www.tu-chemnitz.de/international/nach-chemnitz/formulare.php

Further to the pre-sessional crash course, the CUT Language Centre offers a range of German language courses running throughout the term. All exchange students are welcome to attend such courses in order to improve their language skills. Although the DSH examination (DSH – German language examination for the access to higher education) is not compulsory for exchange students, you may decide to take it anyway.
For the current course catalogue of the CUT Language Centre, please check:

www.tu-chemnitz.de/sprachenzentrum

H. Insurances

1. Health Insurance

In Germany all international students need a valid health insurance. However, you can be exempted from the compulsory health insurance if your home country has signed a reciprocal Health Insurance Agreement with Germany. This is the case with member states of the European Union (EU) as well as some other European countries (e.g. Hungary, the Czech Republic). Therefore, before leaving for Germany you should contact the respective authorities in your home country and obtain the relevant form (e.g. E 111, E 128) as proof of a valid health insurance in your country. After your arrival in Chemnitz you will have to show this form to one of the statuary health insurance agencies (e.g. AOK). You will then receive a temporary medical card which you will have to present whenever you need medical treatment.
Students from countries with which Germany has no National Insurance Agreement (e.g. some of the East and Central European countries) must sign a contract with a statutory health insurance (e.g. AOK) for the time of their stay in Chemnitz.

2. Liability Insurance

At the TU Chemnitz, there is no requirement for a third-party liability insurance policy. But students are advised to subscribe to an insurance policy in their home country.

I. Practical Information about Chemnitz

1. Public Transport

After you have registered as a CUT student, you will be entitled to use all means of public transport in the city of Chemnitz. Your semester fee includes a semester ticket which is valid for all buses and trams of the Chemnitzer Verkehrsbetriebe (Chemnitz Public Transport Company, CVAG). The ticket is printed onto your CUT student identity card, which means that you need to have your student ID with you every time you use public transport in Chemnitz.

From the campus (Reichenhainer Straße) to the centre of the town, it only takes you 5 minutes (bus number 32 & 42).
From the main bus station (Zentralhaltestelle) in the city centre, it is possible to get the 2 major shopping centres by using the public transport system :
- Alt-Chemnitz-Centre : tram No. 6 - 15 minutes.
- Chemnitz - Centre Röhrsdorf : bus No. 21 - 25 minutes.

In addition, there are regional buses or trains, which operate between Chemnitz and other cities (for instance, Chemnitz - Dresden, 80 km)

2. Banks

There are affiliates of several major German banks located in Chemnitz :
There, an account can be opened at no charge and with a copy of a valid students Id, fees can be reduced or waived.

3. Tourist Information Office :

Markt 1, 09111 Chemnitz
Office hours : Mon. - Fri. : from 9 a.m. to 6 p.m. / Sat. : from 9 a.m. to noon

J. History and News

Chemnitz was founded on the banks of the river Chemnitz, after which the city was named. It had the status of a free imperial town, and around 1136-1137, the Emperor Lothar III founded a Benedictine monastery there. But the year 1165 is considered the official date of foundation.
After the city had obtained the bleaching monopoly in 1357, Chemnitz became a centre of weaving and manufacture of linen. At the same time, the growth of iron ore extraction had great influence on the economic rise of the city. In the 15th century, a small copper processing factory was founded. During the 16th century, cotton was introduced into the textile industry, and at the end of the Middle Ages Chemnitz became an important center for textile manufacture in Saxony; products were even exported abroad. From 1728 onward, the hosiery trade was developed and gradually became the main industrial branch. At the end of the 18th and beginning of the 19th century, the textile manufacture was industrialized. From 1800 onward, Chemnitz took the lead in Germany's mechanical industry and production of machine tools.

From the Past into the Present
Innovation has a strong tradition in Chemnitz. Georgius Agricola, who was a humanist, scientist and Mayor of Chemnitz in the 1530s, laid the foundations for the close link between engineering, science and culture in the south-west of Saxony. What is now the Chemnitz University of Technology (CUT) had its foundation in the establishment of the Royal Mercantile College (Königliche Gewerbschule) in 1836, which catered for the region's demand for well-trained experts. Thus, Chemnitz continued the endeavours of Agricola.
In 1900, the year the number of students hit the 1,000 mark for the first time, the status of "Royal Technical Academy" (Königliche Gewerbeakademie) was awarded to the school. The number of students who studied Mathematics, Sciences and Engineering at the "College of Mechanical Engineering", as the school was called since 1953, continued to increase steadily and received a new boost in 1986, when the college was recognised as "Technical University". In 1992 and 1993, the two new faculties were established, i.e. the Faculty of Economics and Business Administration and School of Humanities and Social Sciences were added to the traditional Faculties of Sciences and Technology. Since then the university has been able to present a wide educational spectrum to its students.
CUT students follow in the footsteps of famous scientists and scholars such as Adolf Ferdinand Weinhold (1841-1917, inventor of the Thermos flask) or Carl von Bach (1847-1931) and Clemens Winkler (1838-1904, discovered the chemical element Germanium). They among others laid the foundations for CUT's strong emphasis on research just as well as implementation which are continued today, mainly concentrating on developing and pace-making fields like technology, management and communication.

Top Marks for the University
The CUT is neither the oldest nor the biggest in Germany, but according to 'Spiegel', a national news magazine, it is one of the most popular ones! Out of 63 universities, Chemnitz came in second in the 'Spiegel' ranking 1999. Two years before, the CUT had even reached the first place in another ranking published by the 'Focus' magazine. Both rankings were the result of nation-wide surveys, in which Chemnitz students gave their university top marks for the quality of the academic supervision, the teaching and the facilities available.
The most recent university ranking, conducted by the 'Stern' magazine and the 'Zentrum für Hochschulentwicklung' (CHE) in 2002, again confirmed CUT's high teaching standards. In 9 out of 16 categories of this ranking, CUT can be found among Germany's top universities.

An Education that Leads to Success

Currently, about 10,000 students from Germany and abroad are studying in CUT's seven faculties and enjoy extremely student-friendly conditions. Practice-oriented projects and a long-standing co-operation with well-known companies and institutions in the region contribute considerably to the success of the University and its graduates. At the same time, CUT is the driving force that has been behind the development of the city of Chemnitz. In recent years, dozens of high-tech firms have been established in and around the city, many of which were founded by CUT graduates.

CUT students receive careful supervision in a total of 70 different courses of study. Chemnitz offers a wide variety of new courses of study such as European Studies, Micro technology, Process Engineering, Information Technology, and Psychology, reflecting the fact that more and more public and private employers are looking for graduates with interdisciplinary qualifications. The "Basic Intercultural Communication Certificate", which can be obtained by all students, is the only qualification of its kind around. It certifies a student's ability to cope with the challenges of living and working in a foreign culture. An additional qualification in "The Impact of Technology on Nature" is also possible. Another special feature of studying here is the so-called "Chemnitz Model" which offers the unique opportunity of getting a degree combining one Arts major with one Engineering or Business Studies major.

Chemnitz University has partnerships with about 150 colleges and universities world-wide and at the moment, 750 of CUT's students are from outside Germany.

Having quickly realized the importance of globalisation, the University has adopted international standards and now offers courses leading to Bachelors and Masters degrees in addition to the traditional German courses leading to University Diplomas and Magister degrees. This makes it easier for Chemnitz students to go abroad and also means that foreign students can more easily come to Chemnitz to study.

It's All on Campus

Unlike most other German universities, Chemnitz is a campus university. Over 80 percent of teaching takes place on the campus: lecture halls, computer pools, student residences, laboratories, libraries, the dining hall, sports facilities, and a kindergarten are all within five minutes walk of each other. And the town centre is only 10 minutes away by bus.

III. DEPARTMENT OF ELECTRICAL ENGINEERING AND INFORMATION TECHNOLOGY

Fakultät für Elektrotechnik und Informationstechnik

A. General Description

1. Address

Technische Universität Chemnitz
Fakultät für Elektrotechnik und Informationstechnik
D - 09107 Chemnitz
Germany
Internet: http://www.tu-chemnitz.de/etit/

Location :
Reichenhainer Str.70
Adolf - Ferdinand - Weinhold - Bau
Chemnitz

2. ECTS Coordinators :

Prof. Dr. Dr. Prof. h.c. mult. Thomas Gessner
Institute of Microsystem and Semiconductor Technology
Professorship Microtechnology and "Center for Microtechnologies" (ZfM)
Secretary : Mrs. Sylvia Langos; Room 342 (3rd floor).
phone : (+49) (371) 531-3130
fax : (+49) (371) 531-3131
email : thomas.Gessner@zfm.tu-chemnitz.de

Dr. Wolfgang Seckel; Room 339
phone : (+49) (371) 531-3261
fax : (+49) (371) 531-3131
email : wolfgang.seckel@zfm.tu-chemnitz.de

The Chemnitz University of Technology graduates of Electrical Engineering are trained and knowledgeable in the following fields :
- They possess extensive, applicable knowledge and skills in the mathematical, natural science, and specialized theoretical disciplines.
- They have mastered the methodology of engineering, including the ability to apply interdisciplinary fields to engineering and familiarize themselves quickly with new scientific fields.
- They are capable of independently and responsibly solving scientific and technical tasks in their field.

There are many diverse employment opportunities for electrical engineering graduates. They occupy research and development positions in the manufacturing industry, such as : mechanical and vehicle engineering, energy supply, environmental engineering, transportation industry, aviation, space travel, as well as services in the public sector, such as the National Post Service, Federal Railway Service, and National Patent Office.
Depending on the individual requirements at these institutions, a scientific career at the University or other research institutions is also possible.

B. Departmental Structure

The Department of Electrical Engineering and Information Technology is structured into **5 institutes**:

Academic Unit	Abbreviation
Institute of Theoretical Electrical Engineering and Measurement Technology *Institut fürTheoretische Elektrotechnik und Meßtechnik*	ITEM
Institute of Automation *Institut für Automatisierung*	IA
Electrical Institute *Elektrotechnisches Institut*	EI
Institute of Information Technology *Institut für Informationstechnik*	IIT
Institute of Microsystem and Semiconductor Technology *Institut für Mikrosystem- und Halbleitertechnik*	IMH

with 17 professorships :

- General and Fundamental Electrical Engineering
- Measurement and Sensor Technology

- System Theory
- Process Automation
- Robot systems

- Electrical Machines and Drives
- Electrical Power and High Voltage Engineering
- Power Electronics and electromagnetic compatibility

- Circuit and System Design
- Circuit Technology
- Communications Engineering
- Radio Frequency Engineering
- Data and Communications Technology

- Optoelectronics and Solid-State Electronic
- Electronic Devices
- Microtechnology
- Microsystems and Precision Engineering

Groups:
- Material Science
- Digital Systems

Scientific Institution: Center for Microtechnologies
Zentrum für Mikrotechnologien (ZfM)

C. Institutes

Institute of Theoretical Electrical Engineering and Measurement Technology
Institut fürTheoretische Elektrotechnik und Meßtechnik - ITEM

Prof. Dr. A. Farschtschi
Prof. Dr. W. Manthey / n.n.

The Institute of Theoretical Electrical Engineering and Measurement Technology offers basic and advanced training in the fields of: Fundamentals of Electrical Engineering, Theoretical Electrical Engineering, Numerical Methods in Electrical Engineering, Electrical Measurement Technology, Electronic Measurement Technology, Sensors and Sensor Signal Processing.
The training is organized in lectures, seminars, and laboratory sessions and is carried out in well equipped labs, lecture halls, and seminar rooms.

Institute of Automation
Institut für Automatisierung - IA

Prof. Dr. Steffen F. Bocklisch
Prof. Dr. Peter Protzel
Prof. Dr. Jozef Suchý

The Institute of Automation offers basic and advanced training in the fields of: Control Engineering / System Theory, Process Analysis and Model-Building, Control of Continuous Systems I (Single Input Single Output Systems), Control of Continuous Systems II (Multi Input Multi Output Systems), System Identification / Digital Control, Non-linear Systems, Fuzzy System Theory, Process automation, Industrial Control Engineering, Real-time systems, Distributed automation systems, Devices of Automation Engineering/Basics of Robotics, Electro-Fluidic Actuators, Adaptive Control, Robotic Systems, Robot Technology, Simulation.
The training is organized in lectures, seminars, and laboratory sessions and is carried out in well equipped labs, lecture halls, and seminar rooms.

Electrical Institute
Elektrotechnisches Institut - EI

Prof. Dr. Wilfried Hofmann
Prof. Dr. Josef Lutz
Prof. Dr. Wolfgang Schufft

The Electrical Institute offers basic and advanced training in the fields of: Electrical Power Engineering, Electrical Machines, Electrical Drives, Design and Theory of Electrical Machines, Drive and Control, Industrial Electronics, Power Electronics, Power Devices, Design and Calculation of Power Electronics Systems, Energy electronics, High-voltage engineering, Power transmission and distribution, Stress of electrical components, Statistics and insulation co-ordination
The training is organized in lectures, seminars, and laboratory sessions and is carried out in well equipped labs, lecture halls, and seminar rooms.

Institute of Information Technology
Institut für Informationstechnik - IIT

Prof. Dr. Reinald Brumme
Prof. Dr. Madhukar Chandra
Prof. Dr. Klaus Franke
Prof. Dr. Dietmar Müller
Prof. Dr. Gerd Wanielik

The Institute of Information Technology offers basic and advanced training in the fields of: Electronic Circuits I and II, Device Measurement, High Frequency Technology I and II, Data Communications, Computer Engineering I and II, Microprocessor systems, Digital communication networks, Integrated Circuit Design, System Design, EDA-Tools, ASIC Design, Basics of Communications Engineering, Telecommunications I / Communications Engineering, Telecommunications II, Digital Systems, Digital Signal Processing.
The training is organized in lectures, seminars, and laboratory sessions and is carried out in well equipped labs, lecture halls, and seminar rooms.

Institute of Microsystem and Semiconductor Technology
Institut für Mikrosystem- und Halbleitertechnik - IMH

Prof. Dr. Wolfram Dötzel
Prof. Dr. Gunter Ebest
Prof. Dr. Joachim Frühauf
Prof. Dr. Thomas Gessner
Prof. Dr. Christian Radehaus

The Institute of Microsystem and Semiconductor Technology offers basic and advanced training in the fields of: Design and Technology in Electrical Engineering, Instrumental Design, Microsystems, Reliability and Quality Assurance, Control Engineering (Microsystem Technology), Electrical/Fractional horsepower drives, Technical optics, CAD, Electronic Drives and Circuits, Electronic Drives, Techniques of Integrated Circuits, Physical and Electrical Design, Basis and Application of Solar Power Engineering, Materials Science in Electrical Engineering, Microtechnologies, Materials and Technolologies in Microsystems and Devices, Semiconductor Device Technology, Optoelectronics, Solid State Electronics and Photonics, Electrophysics, Optocommunication.
The training is organized in lectures, seminars, and laboratory sessions and is carried out in well equipped labs, lecture halls, and seminar rooms.

D. Structure of Studies : degree programme „Electrical Engineering“

Duration of study : 5 years
Degree : Diploma - Engineer

The study in the Department of EE&IT consists of four semesters of **Basic Studies** (***Grundstudium***), and six semesters of **Main Studies** (***Hauptstudium***), including one semester of practical training (internship) and one semester - the diploma semester - where students are required to do research on a certain topic and write a publishable paper on it.

Year	Semester	
1.	**1 + 2**	**Basic Studies** - *Grundstudium* :
	and	study and
2.	**3 + 4**	basic practical training
		Examination : Pre - diploma - *Diplom-Zwischenprüfung*
3.	**5 + 6**	**Main Studies** - *Hauptstudium* :
	and	specialization and
4.	**7 + 8**	student research project
5.	**9**	Stays abroad / practical training - *Fachpraxis*
	10	Diploma thesis - *Diplomarbeit*

The recommended period for students who want to enrol in an exchange programme is in their 4th and 5th year of study. The duration could vary from 3 to 12 months.

Basic Studies (*Grundstudium*)

The first 2 years (4 semesters) are devoted to basic courses in mathematics, physics, mechanics, electrical engineering, electronics, computer science, theoretical electrical engineering, material science, etc. Each course is a compulsory subject and has to be completed by a successful examination.
A basic practical training of 6 weeks is scheduled for the period of basic studies, during the break time between the semesters. It is recommended to complete the basic practical training before the beginning of the courses.
The basic studies are completed with an intermediate examination : the Pre-diploma.

Main Studies and Specialization (*Hauptstudium*)

The aim of the main studies is to specialize and reinforce the education of the student and to prepare him / her for independent and scientific professional activities. By the end of period of the basic studies, the students should be enrolled in one of the following fields of specialization:

Electronics / Microelectronics	*Elektronik / Mikroelektronik*
Microsystems and Precision Engineering	*Mikrosystem- und Gerätetechnik*
Electrical Power Engineering	*Elektrische Energietechnik*
Automation & Control Engineering	*Automatisierungstechnik*
Information Technology	*Informationstechnik*

Each specialization consists of 6 **Obligatory Classes / Courses (*Pflichtfächer*)**, and several (at least 3) **Selected Obligatory Classes / Optional required subjects (*Wahlpflichtfächer*)** chosen from 3 or 4 different groups of subjects called **blocks** in volume of 53 cr. to 60 cr.

The students of EE&IT at the Chemnitz University have to enrol in several **non - technical courses** (***Studium generale***), from the Humanities Department and the Department of Economics. These courses are also completed by an examination.
Furthermore, the students are recommended to register for **optional classes / subjects (*Wahlfächer*)**.

During the main studies, there are ten marked proofs of achievements. The specialization in which the student has enrolled allows him to organize his main studies by himself within certain limits. His individual plan has to be approved by the head of the specialization of study one year after the completion of the basic examinations.

The 4th year is completed by a **student research project** (***Studienarbeit*** - 8th semester) - lasting 3 months.

The 9th semester is generally reserved for the period of **Practical Training** (***Fachpraxis- 20 weeks*)** . It can take place also in the industry or at a university abroad.

In the 10th semester, the studies are concluded by a 6 month research period and a **diploma thesis** (***Diplomarbeit***) presented orally.

The successful completion of studies is documented by a report on the final Diploma examination and a Diploma certificate, by which the academic degree of Diploma-Engineer is conferred.

The definite rules are published in the examination regulation.
To be found under:

www.tu-chemnitz.de/etit/studium/stuord/index.php

IV. LECTURE COURSES

A. General Introduction

In the tables, the figures indicate the number of hours per week for **l**ectures (L), **e**xercise classes (E), and **p**ractical (course) (P).

Each course of lectures is described as follows :

Microsystems - *Mikrosystemtechnik*
S 3 0 0 W 1 1 1 9 cr

abbreviation of the institute in German (see table on page 20)

Microsystems	Title of the course of lectures in English - *in German*
S 3 0 0 , **W** 1 1 1	Course of lectures is held in W = winter semester S = summer semester
3 , 1	Hours of lectures / week / semester.
0 , 1	Hours of exercises / week / semester.
0 , 1	Hours of practical / week / semester.
9 cr	ECTS total credits for the winter and summer semesters.

Allocation of credits

Basic Studies (4 semesters)	**120 cr**
Main Studies (6 semesters)	**180 cr**
including	
- all classes completed by passing an examination in obligatory subjects, limited options and optional subjects of the respective specialisation of study	120 cr
- internship \ working at a special project	15 cr
- senior thesis	15 cr
- Diploma thesis (over a period of 6 - 9 months)	30 cr
	300 cr (total)

In the following, the courses which comprise the Basic and Main parts of the studies in electrical engineering are presented. The optional classes and the „generale“ studies are listed at the end of this package.

B. Courses of Basic Studies (*Grundstudium*)

The Basic courses / „Stage I studies“ are listed for information only, as each ECTS student completes the Basic courses at his home university. Therefore no ECTS credits are given for classes in Basic Studies.

Subject	Semester 1. V - Ü - P	2. V - Ü - P	3. V - Ü - P	4. V - Ü - P	Total V - Ü - P	Grand Total
Mathematics I	4 - 3 - 0	4 - 3 - 0 *			**8 - 6 - 0**	**17**
Mathematics II			3 - 2 - 0	3 - 2 - 0 *	**6 - 4 - 0**	**12**
Physics	4 - 2 - 0	2 - 1 - 2 *			**6 - 3 - 2**	**13**
Computer Science	2 - 2 - 0	2 - 2 - 0 *			**4 – 4 - 0**	**9**
Fundamentals of Electr.Eng.	3 - 2 - 0	3 - 2 - 1	2 - 1 - 2 *		**8 - 5 - 3**	**19**
Electronic Devices and Circuits			2 - 1 - 0	1 - 1 - 2 *	**3 - 2 - 2**	**9**
Electrical Power Eng.			2 - 1 - 0 **		**2 -1 - 0**	**3**
Basics of Communications Engineering				2 - 1 - 0 **	**2 - 1 - 0**	**3**
Theoretical Electrical Eng.				3 - 2 - 0 *	**3 - 2 - 0**	**6**
Design and Technology in Electrical Engineering	2 - 1 - 0	1 - 1 - 0 *			**3 - 2 - 0**	**6**
Materials of Electrical Eng.			2 - 0 - 0	0 - 0 - 1 **	**2 - 0 -1**	**3**
Technical Mechanics				2 - 2 - 0 *	**2 - 2 - 0**	**5**
Control Engineering / System Theory			2 - 1 - 0	2 - 1 - 1 *	**4 - 2 - 1**	**9**
Electrical Measurement Technology			2 - 1 - 0	0 - 0 - 1 **	**2 - 1 - 1**	**4**
Non-technical optional compulsory subject			2 - 0 - 0 **		**2 - 0 - 0**	**2**
Semester total L - E - P	**15 - 10 - 0**	**12 - 9 - 3**	**17 - 7 - 2**	**13 - 9 - 5**	**57 - 35 - 10**	
Semester total L+E+P	**25**	**24**	**26**	**27**		**120**

L hours of lectures per week and semester
E hours of exercises per week and semester
P hours of laboratory practical (course) per week and semester

* Examination during the period of exams, at the end of the last semester
** Completion of the class will be confirmed with an attendance certificate (proof of academic achievement) issued by the respective chair. No exams are scheduled for the official exams period.

Mathematics I, II Lecturers: Prof. Dr. G. Wanka
Mathematik I, II Dr. M. Lorenz

Physics Lecturer: Prof. Dr. Chr. v. Borczyskowski
Physik

Computer Science Lecturer: Dr. A. Müller
Informatik

Technical Mechanics Lecturer: Prof. Dr. J. Naumann
Technische Mechanik

Fundamentals of Electrical Engineering
Grundlagen der Elektrotechnik
W 3 2 0 S 3 2 1 W 2 1 2 19 cr

The aim of this 16-hour credit program is to comprehensively impart basic knowledge and methods of thinking in electrical engineering. Classes focus on circuitry and its mathematical models -networks- , fields and their applications in the conversion of energy.
In the first semester, basic analysis techniques are taught. The curriculum comprises linear and non-linear resistive circuitry including basic principles of network theory, and the electrical field in conductors and non-conductors.
During the second semester, the field concept is extended to include magnetic fields, induction processes, effects of force, and the basic principles of converting energy. The network concept is continued with ac (alternating current) circuitry, complex ac calculation, frequency response curves and loci of points, characteristics of transmission (especially of RC-circuits), and resonance effects.
In the third semester, four-terminal networks and multiwave transactions are investigated including the treatment of the dynamic behaviour of linear and non-linear circuitry by Laplace Transformations and the Description of States.
The class work is enhanced by exercises and practical experiences in a laboratory of electrical engineering.

Prerequisites: none
Examination: written
Lecturer: Prof. Dr. A. Farschtschi

Electronic Devices and Circuits
Elektronische Bauelemente und Schaltungen
W 2 1 0 S 1 1 2 9 cr

In the first section, this course conveys the basics of semiconductor technology and knowledge of the function and properties of the important semiconductor and optoelectronic devices. The emphasis is put on diodes, bipolar transistors, field-effect transistors and thyristors.
The second section deals with the basics of analog and digital circuit technology. In the analog part, these are circuits for rectification, stabilization, frequency tuning, regulation, amplification, and the realization of special functions, such as switching operation. Methods for the analysis and dimensioning of small-signal amplifiers, power amplifiers and operational amplifiers are discussed.
The digital part comprises circuit families as well as selected combinatorial and sequential circuits (multiplexers, coders, adders, flip-flops, shift registers, counters, dividers, and others).

Prerequisites: Basics of electrical engineering
Examination: written
Lecturer: Prof. Dr. G. Ebest

Electrical Power Engineering
Elektrische Energietechnik
W 2 1 0 3 cr

The course introduces the field of power engineering and is divided into 3 parts consisting of power supply, power conversion, and control. Basic principles of the generation and distribution of electric energy are presented.
Fundamental methods of energy control by power electronics conclude the course.

Prerequisites: Basics of Electrical Power Engineering
Examination: Course Certificate
Lecturers: Prof. Dr. W. Hofmann / Prof. Dr. W. Schufft

Basics of Communications Engineering
Grundlagen der Nachrichtentechnik
S 2 1 0 3 cr

The lecture treats of the history and economical aspects of communication, Shannon´s basic model of information, relationship information/signal, classes of signals, periodic signals, spectrum, transmission via LTI-systems, non periodic signals, spectrum, transmission via LTI-systems, signal synthesis, application of distributions, distortion free transmission of signals.

Prerequisites: Mathematics, basics of electrical engineering
Examination: written
Lecturer: Prof. Dr.-Ing. G. Wanielik

Theoretical Electrical Engineering
Theoretische Elektrotechnik
S 3 2 0 **6 cr**

The lecture deals with the calculation of the magnitude of electromagnetic fields. Electrostatic, magnetostatic, stationary, quasi-stationary and high frequency fields are presented employing Maxwell's equations in integral and differential form. The most important methods of calculation are shown, with several typical examples. The contents of this lecture is enriched with various exercises and examples.

Prerequisites: Basics of electrical engineering
Examination: written
Lecturer: Prof. Dr. A. Farschtschi

Design and Technology in Electrical Engineering
Konstruktions- und Fertigungstechnik
W 2 1 0 **S 1 1 0** **6 cr**

This class investigates
common problems of Electrical Engineering, such as flow of information, matter and energy,
design methods and technical drawings of mechanical and electrical components,
tolerances and fits, influence of temperature, tolerance chain dimensioning,
stress and strength,
circuit boards: design, technology, component insertion, contacting, test,
mechanical and electrical connections,
practical training in special problems, manual and computer aided design of printed circuit boards.

Prerequisites: Basic course of electrical engineering,
Examination: written
Lecturer: Prof. Dr. W. Dötzel

Materials Science in Electrical Engineering
Werkstoffe der Elektrotechnik / Elektronik
W 2 0 0 **S 0 0 1** **3 cr**

The course contains the basic education in materials science in the studies of electrical science for engineers. The lectures are divided into two main parts: fundamental principles of materials science and special materials for electrical engineering and electronics. In the first part, chemical bonds and the structures of solids, thermally activated processes, phase equilibria, and deformation mechanisms in materials are explained. The subjects of the second part are electrical conductors, semiconductors, insulators and dielectric and magnetic materials. The emphasis is on the interconnections between properties, structures and material processing. Metallographical techniques, materials testing, and the measurement of electrical and magnetic properties, including a result evaluation will be conducted during the laboratory studies.

Prerequisites: none
Examination: Course attendance certificate
Lecturers: Prof. J. Frühauf

Control Engineering / System Theory
Regelungstechnik / Systemtheorie
W 2 1 0 S 2 1 1 9 cr

Introduction into Boolean Algebra; Design of combinational networks; Modelling of binary automates; Design of sequential switching circuits;
Introduction into control systems; Control engineering and control technology; Linearization;
Basic characteristics of linear systems; Description of linear systems in time- and frequency domain; Laplace Transform and its inversion; Analysis of continuous control loops; Controling variables and disturbance quantities; Algebraic stability criterias

Prerequisites: Mathematics, set theory
Examination: written
Lecturer: Prof. Dr. S. F. Bocklisch / Prof. Dr. R. Barthel

Electrical Measurement Technology
Elektrische Meßtechnik
W 2 1 0 S 0 0 1 4 cr

Basic measurement techniques; fault assessment; problems of measuring signal acquisition; measurement of electrical and magnetical quantities, electrical measurement of non-electrical quantities.

Prerequisites: Basics of electrical engineering
Examination: written
Lecturer: Prof. Dr. W. Manthey / n.n.

C. Courses of Main Studies (*Hauptstudium*)

In the following, tables of the compulsory / obligatory courses in different specializations of the main studies are given. Furthermore, the contents of all courses offered in the Main Studies / „Stage II studies“ are listed according to the numbering scheme presented earlier.

L hours of lectures per week and semester
E hours of exercises per week and semester
P hours of laboratory practical per week and semester

1. Courses in *Automation & Control Engineering*

subject	Semester 5. V - Ü - P	6. V - Ü - P	7. V - Ü - P	8. V - Ü - P	total V - Ü - P	grand total
Compulsory subjects						
1. Devices of Automation Engineering / Basic of Robotics	2 - 1 - 0	2 - 1 - 2			**4 - 2 - 2**	**13**
2. Process automation	2 - 0 - 2	2 - 0 - 0			**4 - 0 - 2**	**10**
3. Sensors and signal processing	2 - 1 - 0	0 - 0 - 2			**2 - 1 - 2**	**8**
4. Process Analysis / Model Building			3 - 2 - 1		**3 - 2 - 1**	**10**
5. Control of Continuous Systems I & II	3 - 2 - 1	2 - 1 - 2			**5 - 3 - 3**	**18**
6. Microprocessor systems	2 - 1 - 0	1 - 0 - 1			**3 - 1 - 1**	**8**
Optional reg. subjects						
Block:						
1.1 Robotic Systems			2 - 2 - 0		**2 - 2 - 0**	**6**
1.2 Robot Technology				2 - 0 - 2	**2 - 0 - 2**	**6**
1.3 Electro-Fluidic Actuators			2 - 1 - 2		**2 - 1 - 2**	**8**
2.1 Industrial Control Engineering		2 - 1 - 0	2 - 1 - 0	0 - 0 - 2	**4 - 2 - 2**	**13**
2.2 Real-time systems / Distributed automation systems			2 - 0 - 0	2 - 0 - 0	**4 - 0 - 0**	**6**
3.1 System Identification/ Digital Control		2 - 1 - 0	2 - 1 - 0		**4 - 2 - 0**	**10**
3.2 Non-linear Systems				2 - 2 - 2	**2 - 2 - 2**	**10**
4.1 Optimum Control			2 - 2 - 0		**2 - 2 - 0**	**6**
4.2 Adaptive Control			2 - 0 - 0	2 - 1 - 0	**4 - 1 - 0**	**8**
4.3 Industrial Electronics		2 - 1 - 0	0 - 0 - 1		**2 - 1 - 1**	**7**
4.4 Electrical Drives		3 - 1 - 0	0 - 0 - 2		**3 - 1 - 2**	**10**
4.5 Fuzzy System Theory				2 - 1 - 0	**2 - 1 - 0**	**5**
4.6 Mathematical Model-Building	2 - 1 - 0				**2 - 1 - 0**	**5**
4.7 Simulation Techniques			2 - 0 - 0		**2 - 0 - 0**	**3**
Semester total L - E - P	**13 - 6 - 3**	**16 - 6 - 7**	**19 - 9 - 6**	**10 - 4 - 6**	**58 - 25 - 22**	
studium generale	4 S W S				**4 - 0**	**6**
Semester total L+E+P	**22**	**29**	**34**	**20**	**62 - 25 - 22**	

Devices of Automation Engineering / Basics of Robotics
Geräte der Automatisierungstechnik / Grundlagen der Robotik
W 2 1 0 S 2 1 2 13 cr

This lecture addresses analogue and digital function units of process control systems with pneumatic and hydraulic auxiliary power.
By outlining the historical development of devices and structures of automation engineering the following topics are discussed:
analogies – electric/fluid/mechanic
function units of information processing
fluidic actuators (pneumatic and hydraulic function units)
mathematical foundations of robotics
kinematics of serial robots
dynamics of serial robots
trajectory planning of industrial robots
Knowledge gained within this lecture is extended by computational and experimental exercises.

Prerequisites: none
Examination: written
Lecturer: Prof. Dr. J. Suchý

Process Automation
Prozessautomatisierung
W 2 0 2 S 2 0 0 10 cr

Objective: Introducing and overview of the broad field of process automation
This course gives a basic introduction to different topics in process automation such as:
Definition and classification of technical processes
Structure of automation systems
Real time processing
Communication in distributed automation systems
Reliability and safety issues
Fault - tolerant systems
Human factors in automation
Knowledge-based process control
Some of these topics are discussed in more detail in advanced courses. The course is accompanied by a laboratory project on programming autonomous mobile robots which concludes in our annual robot competition.

Prerequisites: Basic knowledge of engineering and computer systems
Examination: oral
Lecturer: Prof. Dr. P. Protzel

Microprocessor Systems
Mikroprozessorsysteme
W 2 1 0 S 1 0 1 8 cr

Objective:
The understanding of the working principles and the performance of microcontrollers and microprocessor systems and their application in real-time processing.
Content:
Basic hardware components (processing units, memory and I/O units, control units),
data and number representation,
single-processor system (central processing unit, addressing modes, interrupt system, memory management unit)
multiprocessor and multicomputer systems
Case studies : Microcontroller I8051 and microprocessorsystem I8086
Program design for real-time applications (processes and multitasking)

Lab work to application and programming of a microcontroller.

Prerequisites:	Basic courses of electrical engineering
Examination:	written
Lecturer:	Prof. Dr. K. Franke

Sensors and Sensor Signal Processing
Sensoren und Sensorsignalauswertung
W 2 1 0 S 0 0 2 8 cr

Introduction to sensors, production technologies of sensors, new materials for sensors, physical principles of measuring elements, circuits for sensor signal processing, measurement methods and techniques, digital measurement methods, computer aided pre-processing of measured values, real time measurement interfaces.

Prerequisites:	Basics of electrical engineering, field theory
Examination:	written
Lecturer:	Prof. Dr. W. Manthey / n.n.

Process Analysis and Model Building
Prozeßanalyse / Modellbildung
W 3 2 1 10 cr

The emphasis of this course is on such topics as introduction to system analysis and modelling on different levels, experimental process analysis, random processes, characteristics of stationary and ergotic processes, time series analysis and prediction, classification methods (including clustering algorithms), artificial neural nets, fuzzy logic, and chaos and evolutionary theory.

Prerequisites:	Control of continuous systems I and II
Examination:	written
Lecturer:	Prof. Dr. S. F. Bocklisch

Control of Continuous Systems I (Single Input Single Output Systems)
Eingrößenregelung
W 3 2 1 **10 cr**

Emphasis of this course : introduction to controller design, deterministic parameter identification, methods for optimum controller design in time and frequency domains, root locus method, analysis and synthesis of time-continuous systems in state-space representation, sensibility analysis.

Prerequisites: Control engineering / system theory
Examination: written
Lecturer: Prof. Dr. S. F. Bocklisch

Control of Continouous Systems II (Multi Input Multi Output Systems)
Mehrgrößenregelung
S 2 1 2 **8 cr**

The following topics are discussed in this class: control systems with several loops, design of MIMO control systems, canonical descriptions, state-space representation and controller synthesis, modal controller synthesis.

Prerequisites: Control of continuous systems I
Examination: written
Lecturer: Prof. Dr. S. F. Bocklisch

Robotic Systems
Robotersysteme
W 2 2 0 **6 cr**

This lecture represents the continuation of the lecture Devices of Automation Engineering/Basics of Robotics and the basic knowledge gained there is assumed. The essence is modelling and control of robots.
The following topics constitute the lecture:
Control of robots in joint and Cartesian coordinates
Model of a robot joint
Control algorithms of a robot joint
Internal and external sensory equipment of a robot; adaptive robots
Force control of a robot
Control systems of robots
Basic principles of parallel robots
Basic principles of redundant robots
Basic principles of flexible robots

The seminars extend the knowledge of the lecture Basics of Robotics. Besides, examples of robot control are computed and simulated.

Prerequisites: none
Examination: oral
Lecturer: Prof. Dr. J. Suchý

Robot Technology
Robotertechnik
S 2 0 2 **6 cr**

This lecture deals mainly with problems of mobile robotics and presents the basics of machine vision within robotics. Accents are laid on the following points:
Kinematics of the mobile robots
Control systems of mobile robots
Internal and external sensors of mobile robots; models of sensors
Localisation of mobile robots
Navigation and trajectory planning
Geometric and algorithmic aspects of machine vision within robotics
Visual servoing of industrial and mobile robots

Experiments with industrial robots including machine vision experiments will be performed within experimental part of this subject.

Prerequisites: none
Examination: oral
Lecturer: Prof. Dr. J. Suchý

Electro-Fluidic Drives
Elektrofluidische Antriebe
W 2 1 2 **8 cr**

The main topics of this lecture are design, dimensioning and optimisation by means of simulation of electro-fluidic systems to implement position, velocity and force feedback control systems. These steps are developed for the controlled system (power element) as well as for analogue and digital signal processing respectively (conventional and non conventional Control algorithms) including the selection of appropriate measuring element.
The training course serves to develop the models and the self-contained simulation of given structures by means of PC. Within the experimental course some experiments are performed and their results are compared with simulation results.

Prerequisites: none
Examination: oral
Lecturer: Prof. Dr. J. Suchý

System Identification / Digital Control
Identifikation / Digitale Regelung
W 2 1 0 **S 2 1 0** **10 cr**

experimental model building (active, passive); discrete-time linear models; characteristics of estimation methods and techniques (bias, consistency);
least squares method (ls): ls for static and dynamic processes, ls for non-linear processes, modifications of ls (generalized ls and enhanced ls), correlation analysis and ls;
problems by using parameter estimation methods and techniques (sampling time, determination of model order, choice of input signals);
system identification using MATLAB (demonstration of examples of use).
Prerequisites: Control of continuous systems I
Examination: oral
Lecturer: Prof. Dr. S. F. Bocklisch

Industrial Control Engineering
Industrielle Steuerungstechnik
S 2 1 0 W 2 1 0 S 0 0 2 13 cr

Objective: Comprehensive introduction to industrial control
This course is concerned with the development of controllers for discrete event-type systems (as opposed to automatic control for continuous systems), which are very common in industrial control. The main emphasis is on different programming methods for programmable logic controllers. The course is application-oriented and the last term consists of various lab exercises using a scaled-down model of a factory controlled by standard industrial controllers.
Prerequisites: Basic knowledge of programming and digital systems theory
Examination: oral
Lecturer: Prof. Dr. P. Protzel

Optimum Control
Optimalsteuerung
W 2 2 0 6 cr

Introduction to optimisation of static control problems (basic ideas, objectives, problem areas), selected fundamentals of Linear Programming (normality, start solution, Simplex-Algorithm, numeric problems), Non-linear Programming (constrained problems), analytical and numerical solution methods (Search algorithms, Penalty-functions), Static Optimisation problems in control-engineering (Identification, principle of Least-Squares, noise suppression, control design), Optimisation techniques with MATLAB Optimisation Toolbox, examples of use.
Prerequisites: Control / system theory
Examination: oral
Lecturer: Prof. Dr. S. F. Bocklisch

Adaptive Control
Adaptive Regelung
W 2 0 0 S 2 1 0 8 cr

This lecture is the introduction into the basics of continuous and discrete adaptive control. The most important approaches of adaptive control developed from 50-ies to 90-ties together with historical overview are given in the comprehensive form.
The following topics are presented in some detail:
Model reference adaptive systems (MRAS) designed with MIT-rule
The basics of the direct method of Lyapunov for the investigation of the stability of non-linear dynamic systems
Design of the continuous and discrete MRAS with the direct method of Lyapunov
Application of the MRAC methodology to design the identification scheme of the continuous and discrete dynamic systems
Adaptive direct and indirect self-tuning algorithms (design of minimum variance self-tuning adaptive systems, design with pole placement, self-tuning PID controllers)
Predictive adaptive algorithms (Smith predictor, GPC – controller, GMAC – controller etc.)

Within the seminars the methods of adaptive control are introduced by means of computation and simulation with appropriate software.

Prerequisites: Control / system theory, SISO- and MIMO-control
Examination: oral
Lecturer: Prof. Dr. J. Suchý

Real-time Systems / Distributed Automation Systems
Echtzeitverarbeitung / Prozessdatenkommunikation
S 2 0 0 W 2 0 0 6 cr

(Real-time systems)
Objectives: Introduction to real-time, concurrent and distributed systems
This course deals with the specific problems of real-time, concurrent and distributed systems. The topics covered include preemptive scheduling methods, tasks synchronization problems and petri nets
(distributed automation systems)
Objectives: Introducing to data and computer communication in distributed automation systems
Today, any larger automation systems utilizes many controllers which are distributed over the plant. These controllers need to communicate via a communication network. In the lowest level of the automation hierarchy these networks are called field busses. This curse introduces different field bus concepts based on their different protocols of the OSI reference model. Because of its increasing importance in automation, the internetworking concept based on the TCP/IP protocol family is also introduced.

Prerequisites: basic knowledge of programming, computer science, communication systems and theory
Examination: oral
Lecturer: Prof. Dr. P. Protzel

Industrial Electronics
Industrielle Elektronik
S 2 1 0 W 0 0 2 7 cr

Equipment of industrial electronics transfers the signals of microelectronics and computers to control the power in automatic production and transport. The course deals with power electronic devices and the basics of power electronic circuits for conversion and control of electrical energy.

Prerequisites: Basic courses of electrical engineering
Examination: oral
Lecturer: Prof. Dr. J. Lutz

Non-linear Systems
Nichtlineare Systeme
S 2 2 2 10 cr

The curriculum comprises: characteristics of non-linear systems, two and three step control, harmonic linearisation and describing function technique, phase plan methods, time optimum control, and Lyapunov's and Popov's stability approach. Finally, an outline of recent developments in non-linear system theory is given.

Prerequisites: control of continuous systems I and II
Examination: oral
Lecturer: Prof. Dr. S. F. Bocklisch

Electrical Drives Electrical Power Engineering
Elektrische Antriebe (page 40)

Fuzzy-System Theory
Fuzzy-Systemtheorie
S 2 1 0 **5 cr**

principles of fuzzy systems; fuzzy sets (linguistic variable, membership function, fuzzy set operators); fuzzy numbers (definition, arithmetic); modelling of fuzzy systems: fuzzy logic, fuzzy pattern classification; applicational areas (fuzzy control systems, fuzzy data analysis);
special project experiences: explorative data analysis, diagnosis, monitoring applications, quality assurance, time series analysis and prediction, pattern recognition, control;
software (demonstration of examples of use).

Prerequisites: Process analysis and model building
Examination: oral
Lecturer: Prof. Dr. S. F. Bocklisch

Mathematical Model Building
Theoretische Modellbildung
W 2 1 0 **5 cr**

types of model building (mathematical/theoretical, experimental, expert based); methodology of mathematical model building; examples of mathematical model building (technical, ecological and economical systems); types of mathematical models (analytical, numerical, graphical); PETRI-net models; methods of modelling (method of operator impedances, method of analysis of cumulative effects, balance method); models with distributed parameters;
mathematical model building and simulation deploying MATLAB/SIMULINK.

Prerequisites: Physics, control / system theory
Examination: oral
Lecturer: Prof. Dr. S. F. Bocklisch

Simulation Techniques
Simulation
W 2 0 0 **3 cr**

This subject deals with simulation methods of dynamic systems in control engineering.
Using PC-programs engineering problems will be discussed, starting with a mathematical model through to the final technical notation for simulation tools.
Furthermore, it will be shown how to simulate technical systems, taking into consideration several integration methods as well as other mathematical correlations.

Prerequisites: Basic knowledge in electrical engineering and system theory
Examination: oral
Lecturer: Dr. R. Neumann

2. Courses in *Electrical Power Engineering*

subject	Semester 5. V - Ü - P	6. V - Ü - P	7. V - Ü - P	8. V - Ü - P	total V - Ü - P	grand total
Compulsory subjects						
1. Electrical Machines	2 - 1 - 0	0 - 0 - 2			**2 - 1 - 2**	**8**
2. Electrical Drives		3 - 2 - 0	0 - 0 - 2		**3 - 2 - 2**	**12**
3. Power Electronics	3 - 1 - 0	1 - 1 - 2			**4 - 2 - 2**	**13**
4. High -Voltage Technology	3 - 1 - 0	0 - 0 - 2			**3 - 1 - 2**	**10**
5. Power Transmission and Distribution		3 - 1 - 0	0 - 0 - 2		**3 - 1 - 2**	**10**
6. Control of Continuous Systems I	3 - 2 - 1				**3 - 2 - 1**	**10**
Optional reg. subjects						
Block						
1.1 Design and Theory of Electrical Machines		2 - 1 - 0	2 - 1 - 0		**4 - 2 - 0**	**10**
1.2 Drive Control			2 - 1 - 0	0 - 0 - 2	**2 - 1 - 2**	**8**
2.1 Semiconductor Devices in Power Electronics			3 - 1 - 1		**3 - 1 - 1**	**8**
2.2 Design and Calculation of Power Electronics Systems				3 - 2 - 0	**3 - 2 - 0**	**8**
3.1 Stress of Electrical Components			3 - 1 - 0	0 - 0 - 1	**3 - 1 - 1**	**8**
3.2 Statistics and Insulation Co-ordination				2 - 1 - 0	**2 - 1 - 0**	**5**
4.1 Telecommunications I	2 - 1 - 2				**2 - 1 - 2**	**8**
4.2 Sensors and Sensor Signal Processing	2 - 1 - 0	0 - 0 - 2			**2 - 1 - 2**	**8**
4.3 Numerical Methods in Electrical Engineering	2 - 0 - 4				**2 - 0 - 4**	**10**
Semester total L - V - P	**17 - 7 - 7**	**9 - 5 - 8**	**10 - 4 - 5**	**5 - 3 - 3**	**41 - 19 - 23**	
studium generale	4 SWS				**4 - 0**	**6**
Semester total L+V+P	**31**	**22**	**19**	**11**	**45 - 19 - 23**	

Electrical Machines
Elektromagnetische Energiewandler
W 2 1 0 S 0 0 2 8 cr

The course deals with the basic construction, practice, phasor diagrams, equivalent circuits, and steady-state behaviour of electric machines.

Prerequisites: Basics of electrical engineering, introduction in power engineering
Examination: oral
Lecturer: Prof. Dr. W. Hofmann

Electrical Drives
Elektrische Antriebe
S 3 2 0 W 0 0 2 12 cr

The course gives an introduction to the physical, thermal, and mechanical basics of electrical drives in connection with typical machines and motion converters, and shows modern points of view for their design.
Furthermore, modern control methods of torque and speed for dc and acdrives realized by power electronic devices are taught. The final part is devoted to control loops and their optimisation with consideration of mechanical systems for drive applications in servos.

Prerequisites: Basic course of electrical engineering, system theory, control engineering
Examination: oral
Lecturers: Prof. Dr. W. Hofmann / Dr. R. Kiehnscherf

Power Electronics
Leistungselektronik
W 3 1 0 S 1 1 2 13 cr

Contents:
Structure, function and technical characteristics of power semiconductor devices. Thermal design and basics of reliability. Power electronic circuits, converter topologies, ac to dc converters, harmonics, power factor, step-up and step-down converters, inverters, variable speed drives.

Prerequisites: Basic courses of electrical engineering
Examination: oral
Lecturer: Prof. Dr. J. Lutz

High - Voltage Technology
Hochspannungstechnik
W 3 1 0 S 0 0 2 10 cr

The lecturer treats with the stress of insulations, the generation of high voltages, the classification and calculation of the electric field as well as with the discharge physics of gaseous, fluid and solid insulations.

Prerequisites: none
Examination: Oral
Lecturer: Prof. Dr. W. Schufft

Power Transmission and Distribution
Elektroenergieübertragung und -verteilung
S 3 1 0 W 0 0 2 10 cr

The lecture treats with the structure and components of the electric power system. It covers also the basics of calculations (like symmetrical components) and their application on the main components of the electric power system.

Prerequisites: none
Examination: oral
Lecturer: Prof. Dr. W. Schufft

Design and Theory of Electrical Machines
Entwurf und Theorie elektrischer Maschinen
S 2 1 0 W 2 1 0 10 cr

The first course gives design and calculation methods for all essential types of electric machines. There are graphical, analytical and computer-based designs, especially of permanent-excitation motors.
The second course introduces modern aspects of machine theory based on space-phasors and gives special applications in controlled drives.

Prerequisites: Electrical machines
Examination: oral
Lecturers: Prof. Dr. W. Hofmann

Drive Control
Automatisierte Antriebe
W 2 1 0 S 0 0 2 8 cr

The course gives modern aspects of controlled drives and drive systems. Starting with fundamental principles of digital single and multivariable control, measuring, and signal processing, special control methods are proposed for ac-drives with accentuated field-oriented control. The field is rounded off by control strategies for mechatronic systems.

Prerequisites: Electrical drives, control engineering
Examination: oral
lecturer: Prof. Dr. W. Hofmann

Semiconductor Devices in Power Electronics
Bauelemente der Leistungselektronik
W 3 1 1 8 cr

Contents: Basic physics of power semiconductors. Basic semiconductor technology. Modern Power Devices: Soft recovery diode, Schottky Diode, Bipolar Transistor, Thyristor, GTO/GCT, MOSFET, IGBT. Power modules. Packaging technology, thermal design, thermal-mechanical effects, reliability. Failure mechanisms, failure analysis. Power electronic systems.

Prerequisites: Power electronics
Examination: oral
Lecturers: Prof. Dr. J. Lutz

Design and Calculation of Power Electronics Systems
Entwurf und Berechnung leistungselektronischer Systeme
S 3 2 0 **8 cr**

The focus of this course is on learning the tools for practical engineering on examples of solving special problems. Contents:
Calculation, design and implementation of a power device, project management.
SiC Power devices.
Packaging technology, reliability, built-in reliability. Smart Power.
Electromagnetic compatibility: Basics, conversion-induced electromagnetic emissions, device induced electromagnetic emissions.
Simulation of power electronic circuits, practical training, converter design using simulation tools.

Prerequisites: Power electronics, Power Devices
Examination: oral
Lecturer: Prof. Dr. J. Lutz

Stress of Electrical Components
Beanspruchung von Betriebsmitteln
W 3 1 0 **S 0 0 1** **8 cr**

The lecture treats with the classification and the description of the stresses of electrical components by inner and outer over-voltages, travelling waves, arcs and short-circuit currents as well as the design and the operating principles of electrical components, especially of switches

Prerequisites: none
Examination: oral
Lecturer: Prof. Dr. W. Schufft

Statistics and Insulation Co-ordination
Statistik und Isolationskoordination
S 2 1 0 **5 cr**

The lecture treats with statistical distribution functions and their application for the description of the dielectric strength of insulations, the planning of high-voltage tests, test procedures to verify the independence of experimental measuring data, basics of the insulation co-ordination as well as basics of the reliability theory, including the calculation of the reliability.

Prerequisites: none
Examination: oral
Lecturer: Prof. Dr. W. Schufft

Telecommunications I Information Technology
Nachrichtentechnik I (page 52)

Sensors and Sensor Signal Processing Automation & Control Engineering
Sensoren und Sensorsignalauswertung (page 33)

Control of Continuous Systems I Automation & Control Engineering
Eingrößenregelung (page 34)

Numerical Methods in Electrical Engineering
Numerische Methoden in der Elektrotechnik
W 2 0 4 **10 cr**

This lecture deals with the numerical calculation of electric, magnetic, and electromagnetic fields. The most important methods (finite difference method, finite element method, equivalent load method, finite network method, method of momentum) are introduced. In exercises and labs, these methods are explained using typical examples on computers. Furthermore, this class focuses on the efficient calculation of large systems of linear equations.

Prerequisites:	Basic courses of theoretical electrical engineering
Examination:	written
Lecturer:	Prof. Dr. A. Farschtschi

3. Courses in *Electronics / Microelectronics*

subject	Semester 5. V - Ü - P	6. V - Ü - P	7. V - Ü - P	8. V - Ü - P	total V - Ü - P	grand total
Compulsory subjects						
1. Electronic Devices	2 - 1 - 0	2 - 1 - 0	0 - 0 - 2		**4 - 2 - 2**	**13**
2. Electronic Circuits I + II	2 - 1 - 0	2 - 1 - 2	0 - 0 - 1		**4 - 2 - 3**	**15**
3. Optoelectronics			2 - 1 - 1		**2 - 1 - 1**	**7**
4. Semiconductor Device Technology	2 - 1 - 0	2 - 1 - 2			**4 - 2 - 2**	**13**
5. Sensors and Sensor Signal Processing	2 - 1 - 0	0 - 0 - 2			**2 - 1 - 2**	**8**
6. Microprocessor Systems	2 - 1 - 0	1 - 0 - 1			**3 - 1 - 1**	**8**
Optional requ. subjects						
Block						
1.1 Solid State Electronics	2 - 1 - 0	2 - 1 - 1			**4 - 2 - 1**	**12**
1.2 Electrophysics	2 - 2 - 0				**2 - 2 - 0**	**6**
1.3 Numerical Methods in Electrical Engineering	2 - 0 - 4				**2 - 0 - 4**	**10**
2.1 Techniques of Integrated Circuits			2 - 1 - 0	0 - 0 - 2	**2 - 1 - 2**	**8**
2.2 Physical and Electrical Design		2 - 1 - 0	1 - 0 - 1		**3 - 1 - 1**	**8**
2.3 Device Measurement			2 - 1 - 0		**2 - 1 - 0**	**5**
2.4 Microtechnologies			2 - 1 - 0	2 - 1 - 0	**4 - 2 - 0**	**10**
2.5 Basics and Application of Solar Power Engineering		2 - 1 - 0		1 - 0 - 1	**3 - 1 - 1**	**8**
2.6 Optocommunication				2 - 0 - 2	**2 - 0 - 2**	**7**
3.1 High Frequency Technology I		2 - 1 - 1	2 - 1 - 1		**4 - 2 - 2**	**13**
3.2 Telecommunications I	2 - 1 - 2				**2 - 1 - 2**	**8**
3.3 Electronic Measurement Technology	2 - 1 - 0	0 - 0 - 2			**2 - 1 - 2**	**8**
3.4 ASIC Design				2 - 1 - 2	**2 - 1 - 2**	**8**
3.5 Industrial Electronics		2 - 1 - 0	0 - 0 - 2		**2 - 1 - 2**	**8**
3.6 Microsystems		3 - 0 - 0	1 - 1 - 1		**4 - 1 - 1**	**10**
3.7 Techniques for Testing Microsystems			2 - 0 - 0	1 - 0 - 2	**3 - 0 - 2**	**8**
3.8 Reliability and Quality Assurance		2 - 0 - 0	2 - 1 - 0		**4 - 1 - 0**	**8**
Semester total L - E - P	**20 - 10 - 6**	**22 - 8 - 11**	**17 - 7 - 10**	**7 - 2 - 8**	**66 - 27 - 35**	
studium generale	4 SWS				**4 - 0**	**6**
Semester total L+E+P	**36**	**41**	**34**	**17**	**72 – 27 - 35**	

Electronic Devices
Elektronische Bauelemente
W 2 1 0 S 2 1 0 W 0 0 2 13 cr

In a first section, the knowledge of the behaviour of integrated semiconductor devices in selected fields is deepened. The emphasis is put on injection effects, frequency behaviour, as well as noise and thermal stability problems. In connection with the reduction of device dimensions the change of characteristic parameters is explained.
Starting from the devices properties conclusions for the modelling and construction are drawn and explained.
The physical and technical basics of liquid-crystal, vacuum, and solid-state devices are covered during the second section. Important devices such as LCDs, vacuum and solid-state displays, microwave oscillators, and modulators, as well as thermistors are discussed. Typical fields of application of the basic circuits are shown.

Prerequisites: Basics of electrical engineering, electronic devices and circuits
Examination: written
Lecturer: Prof. Dr. G. Ebest

Electronic Circuits I
Elektronische Schaltungstechnik I
W 2 1 0 S 0 0 2 8 cr

After an introduction into the structure, properties and applications of digital circuits (logic circuits, memories), mainly analog circuits are discussed. Within this scope the principles of operation and calculation of basic circuits, the structure and application of integrated circuits are reviewed. Especially basic analog circuits, such as amplifiers, standard filters, signal generators, power supplies, and optoelectronics are considered.

Prerequisites: Foundation course of electric engineering, information technology
Examination: written
Lecturer: Prof. Dr. R. Brumme

Electronic Circuits II
Elektronische Schaltungstechnik II
S 2 1 0 W 0 0 1 7 cr

This lecture is a continuation of Electronic Circuits I. More information is given on RC-filters and filters with negative impedance. Further topics are circuits for non-linear signal processing, PLLs, digital-analog and analog-digital converters, and pulse technologies.

Prerequisites: Foundation course of electric engineering, information technology, electronic circuits
Examination: written
Lecturer: Prof. Dr. R. Brumme

Optoelectronics
Optoelektronik
W 2 1 1 **7 cr**

This lecture starts with the physical fundamentals of electromagnetic waves. This includes the concept of photons, polarization, coherence as well as the interaction between radiation and matter making the refractive index of materials. After this, optoelectronical radiation sources and detectors such as light emitting diodes (LED), laser diodes (LD), photo diodes, and solar cells are introduced. Finally, the basic principles of optical signal transmission including technical components, such as optical waveguides, modulators, optical amplifiers and integrated optics will be discussed.

Prerequisites: Solid state electronics, photonics
Examination: written
Lecturer: Prof. Dr. C. Radehaus

Semiconductor Device Technology
Technologien der Mikroelektronik
W 2 1 0 **S 2 1 2** **13 cr**

This course introduces the basic technologies and typical manufacturing processes of semiconductor components (bipolar and unipolar / CMOS devices) and microsystem structures.
Lectures are held on the following topics:
Clean rooms and equipment, Doping processes and Ion Implantation, Thermal Oxidation, CVD and PVD processes, Lithography / Structuring / dry and wet Etching, Mask producing, CMP, etc.
A period of practical work in the university's Center for Microtechnologies is scheduled for the summer semester. The students are acquainted with special equipment (Microscopy, CVD & PVD, Thermal Oxidation, Lithography, Bonding etc.).

Prerequisites. Physics, electronic devices & circuits
Examination: oral
Lecturer: Prof. Dr. T. Gessner

Sensors and Sensor Signal Processing Automation and Control Engineering
Sensoren und Sensorsignalauswertung (page 33)

Microprocessor Systems Automation and Control Engineering
Mikroprozessorsysteme (page 33)

Solid State Electronics and Photonics
Festkörperelektronik und - photonik
W 2 1 0 S 2 1 1 12 cr

In the first major part the students are introduced to chemical bonds and crystals. Specially the basics of crystallographic such as crystalline structures, refraction and reciprocal lattice is taught. The following part is devoted to electrons in solid state material. This includes energy band model, charge carrier transport in metals, semiconductors and insulators. Furthermore the behaviour of Semiconductor - Semiconductor (SS), Metal - Semiconductor (MS), Metal-Insulator (MI), and Metal-Insulator-Semiconductor (MIS) structures are discussed. Taking this as basics, the structure and operation principles of well-known electronic devices such as diodes and transistors as well as newly developed electronic components (single-electron-tunneling SET devices) are discussed.
The second major part of the lecture includes electromagnetic waves, interaction between radiation and solid state materials. This includes important topics such as interference, coherence, polarization, emission and absorption.

Prerequisites: Basics of physics and electrical engineering
Examination: written
Lecturer: Prof. Dr. C. Radehaus

Electrophysics
Elektrophysik
W 2 2 0 6 cr

The course provides a introduction to quantum mechanics for engineers. Starting with classical mechanics the Hamilton function is introduced. In the following the concepts of field-description as well as wave equations are presented. By introducing the photo-effect, the Compton-effect and the particle wave dualism, the basics of quantum mechanics are discussed. In the following the Schrödinger-equation, bounded and unbounded states, angular momentum, spin, as well the superposition principle as basic tools for the quantum mechanical treatment of solid state materials are treated.

Prerequisites: Physics
Examination: written
Lecturer: Prof. Dr. C. Radehaus

Numerical Methods in Electrical Engineering Electrical Power Engineering
Numerische Methoden in der Elektrotechnik (page 43)

Techniques of Integrated Circuits
Integrierte Schaltungstechnik
W 2 1 0 S 0 0 2 8 cr

The course conveys the functional features and sizing guide lines of modern electronic circuits like CMOS, BiCMOS, Domino, EFL under the aspect of microelectronic integration. Particularly tolerance and reliability problems are considered.
Static and dynamic digital gates, analog circuits, memory circuits and selected special circuits like Schmitt triggers, oscillators, and many more are discussed. Time behaviour, static behaviour, power consumption, and temperature behaviour are in the foreground of the analysis and dimensioning.
The conception of complex circuits and architectures are demonstrated in examples.

Prerequisites: Basics of electrical engineering, electronic devices and circuits, circuit technology
Examination: written
Lecturer: Prof. Dr. G. Ebest

Physical and Electrical Design
Physikalischer und elektrischer Entwurf
S 2 1 0 W 1 0 1 8 cr

Beginning with the requirements of microelectronics, the design steps of monolithically integrated circuits are explained and established.
The physical design includes the basics of layout design based on typical microelectronic technologies. The emphasis is put on derivation and application of topologic design rules as well as on important design methods.
The electrical design comprises device modelling, network analysis, and logic simulation. Goals, algorithms, models, programs, convergence problems, extraction methods, and possibilities of testable designs are included in respective sections.
In a laboratory computer work, students design and simulate a complex circuit, which includes the various design aspects ranging from logic to layout design.

Prerequisites: Basics of electrical engineering, electronic devices and circuits, device technology
Examination: written
Lecturer: Prof. Dr. G. Ebest

Device Measurement
Bauelementemeßtechnik
W 2 1 0 5 cr

These lectures and exercises focus on the measurement and test of electronic devices as well as analog and digital circuits. Subjects are the fundamentals of measurement, verification, and testing. Test technologies, the measurement of discrete semiconductor devices in integrated analog and digital circuits, and testing of digital and analog circuits are illustrated.

Prerequisites: Basic course of electric engineering, information technology
Examination: written
Lecturer: Prof. Dr. R. Brumme

Microtechnologies
Mikrotechnologien
W 2 1 0 S 2 1 0 10 cr

A short introduction reviews the special demands on materials in technologies of microsystems and devices. Because of the importance of crystal properties, the explanation of their tensor representation and crystal symmetries (matrices of transformation and stereographic projection) follows. Another subject is Functional Materials of Transducers (transformation of thermal, mechanical, magnetic, optical, or chemical energy in electrical energy and vice versa). The application of semiconductor materials, metals, glasses, ceramics, and polymers as construction materials (substrates, wires, solders, adhesives, casings, coatings) concludes the series of lectures. In Labs, students work on the following topics: elastic constants of the silicon monocrystal, properties of silicon wafers (crystallographical, geometrical, and electrical properties), dielectric properties of glasses, ceramics and polymers.
Special technologies and their applications in the production of silicon based devices are demonstrated: micromechanical scanning systems for electromagnetic waves / actuators, flow sensors, micromechanical pressure sensors, distance sensors, high precision acceleration sensors, chemical (ISFET) and biological sensors, and micromechanical components (pumps, valves).

Prerequisites: Materials of electrical engineering
Examination: written
Lecturers: Prof. J. Frühauf / Prof. Dr. T. Gessner

Basics and Application of Solar Power Engineering
Grundlagen und Anwendung der solaren Energietechnik
S 2 1 0 W 1 0 1 8 cr

Power generation and energy sources are critically analysed in a global context, and consequences are shown. The state of the art of power generation from alternative and regenerative energy sources are represented and evaluated with respect to technical, economical, and ecological aspects.
The emphasis of the course is put on solar power engineering. In this context, both single components and complete systems are discussed. Contents are radiation laws, solar spectrum, function, fabrication, and properties of solar cells, concentrator arrangements, modules, basic and control circuits, energy storage, and inversion. Problems of matching the photovoltaic energy as well as the construction and the operation of photovoltaic systems are, thereby, included.

Prerequisites: Basics of electrical engineering, electronic devices and circuits
Examination: written
Lecturers: Prof. Dr. G. Ebest / Prof. Dr. Hiller

Optocommunication
Optokommunikation
S 2 0 2 7 cr

This lecture introduces fundamental concepts and examples of optical signal transmissions. After the introduction, the basics of electromagnetic waves will be discussed respectively repeated. On this basis the main principles of optical communication and signal transmission through various media such as optical waveguides and free space are introduced. Furthermore, the characteristics of optical fibres and technical components used to emit and receive light, principles of modulation and demodulation is taught. In addition, measurement procedures of optical components and links are discussed. The final part deals with fundamentals of optical networks and their practical realization.

Prerequisites: Solid State Electronics, Optoelectronics
Examination: oral
Lecturer: Prof. Dr. C. Radehaus

High Frequency Technology I Information Technology
Hochfrequenztechnik I (page 53)

Telecommunications I Information Technology
Nachrichtentechnik I (page 52)

Electronic Measurement Technology
Elektronische Meßtechnik
W 2 1 0 S 0 0 2 8 cr

This lecture deals with the physical and technical limitations of measurable physical quantities, electronic measuring devices for data logging, correlation measurement technology, polynomial interpolation techniques, digital measuring signal processing, applications for spectral analyses, shielding technologies, laser distance measurement technologies, measurement technologies based on wave propagation, and standard interfaces.

Prerequisites: Basics of electrical engineering
Examination: written
Lecturer: Prof. Dr. W. Manthey / n.n.

ASIC Design Microsystem and Precision Technology
ASIC-Entwurf (page 62)

Industrial Electronics Automation & Control Engineering
Industrielle Elektronik (page 37)

Microsystems Microsystem and Precision Technology
Mikrosystemtechnik (page 58)

Control Engineering Microsystem and Precision Technology
Prüftechnik (Mikrosystemtechnik) (page 60)

Reliability and Quality Assurance Microsystem and Precision Technology
Zuverlässigkeit und Qualitätssicherung (page 59)

4. Courses in *Information Technology*

subject	Semester 5. V - Ü - P	6. V - Ü - P	7. V - Ü - P	8. V - Ü - P	total V - Ü - P	grand total
Compulsory subjects						
1. Telecommunications I	2 - 1 - 2				**2 - 1 - 2**	**8**
2. Integrated Circuit Design	2 - 1 - 1	2 - 1 - 1			**4 - 2 - 2**	**13**
3. High Frequency Technology I		2 - 1 - 1	2 - 1 - 1		**4 - 2 - 2**	**13**
4. Electronic Circuits	2 - 1 - 0	0 - 0 - 2			**2 - 1 - 2**	**8**
5. Computer Engineering	2 - 1 - 0	2 - 1 - 2			**4 - 2 - 2**	**13**
6. Digital Systems	3 - 2 - 0				**3 - 2 - 0**	**8**
Optional requ. subjects						
Block						
1.1 Digital Information Processing	2 - 0 - 0	2 - 1 - 0			**4 - 1 - 0**	**8**
1.2 Electronic Measurement Technology	2 - 1 - 0	0 - 0 -2			**2 - 1 - 2**	**8**
1.3. Electronic Circuits II		2 - 1 - 0	0 - 0 - 1		**2 - 1 - 1**	**7**
2.1 System Design		2 - 0 - 0	1 - 0 - 2		**3 - 0 - 2**	**8**
2.2 EDA-Tools			2 - 1 - 0	2 - 0 - 2	**4 - 1 - 2**	**12**
2.3 Integrated Circuit Design			2 - 1 - 0	0 - 0 - 2	**2 - 1 – 2**	**8**
3.1 Data Communications	2 - 0 - 0	2 - 1 - 0			**4 - 1 - 0**	**8**
3.2 Telecommunications II			2 - 1 - 0	2 - 1 - 0	**4 - 2 - 0**	**10**
3.3 High Frequency Technology II				2 - 1 - 0	**2 - 1 - 0**	**5**
3.4 Optocommunication				2 - 0 - 2	**2 - 0 - 2**	**7**
Semester total L – E- P	**17 - 7 - 3**	**14 - 6 - 8**	**9 - 4 - 4**	**8 - 2 - 6**	**48 - 19 - 21**	
studium generale	4 SWS				**4 - 0**	**6**
Semester total L+E+P	**27**	**28**	**17**	**16**	**52 - 19 - 21**	

Telecommunications I / Communications Engineering
Nachrichtentechnik I
W 2 1 2 **8 cr**

The lecture treats of multiple access techniques (TDMA, FDMA, CDMA, SDMA), analog amplitude and angle modulation (time-domain signals, spectral characteristics, effect of distortion, demodulation), comparison of modulation methods (bandwidth need, influence of distortion), digital modulation methods (ASK, BPSK, QPSK, QAM, mathematical description of the signal, constellation diagram, spectral characteristics, demodulation, matched-filter-type demodulator), effect of noise (AWGN, BER), advanced digital modulation techniques (OFDM, CDMA in UMTS). An outlook to the future development closes the lectures.

Prerequisites: Basics of electrical engineering
Examination: written
Lecturer: Dr.-Ing. U. Neubert

Integrated Circuit Design
Schaltkreisentwurf
W 2 1 1 **S 2 1 1** **13 cr**

Different types of integrated circuits representing the state of the art in microelectronics will be presented, the design flow will be explained, and the term „application-specific integrated circuit“ (ASIC) will be defined. User-reconfigurable and mask programmable ASICs will be discussed in detail with regard to their architecture, commercially available design tools, and the design flow. ASIC types covered are PLDs, FPGAs of various architectures and technologies, gate arrays, and standard cells. Structural and functional test issues (LSSD, scan path, JTAG) are also considered.
The lectures are accompanied by seminars, and within the laboratory projects students will consolidate their design skills.

Prerequisites: Electronic devices and circuit technology, computer science
Examination: written
Lecturer: Prof. Dr. D. Müller

High Frequency Technology I
Hochfrequenztechnik I
S 2 1 1 W 2 2 1 13 cr

This lecture course deals with fundamental aspects of Microwave techniques and engineering. After a short introduction, an overview of the typical applications of microwave engineering is offered. Subsequently, the microwave related EM-Theory and the theory of transmission lines are covered together with their equivalent circuits, their realizations and their applications. This offers the foundation for the introduction of the Smith-chart and, scattering parameters for two-port circuits. For ensuring the understanding of coupled structures, the required introduction to circuit modes is provided. The course material dealt with so far relies on the TEM solution of Maxwell equations. However, for a more general understanding, non-TEM solutions are derived and discussed for a number of wave guide structures. After the presentation of the passive microwave components and their techniques, active elements are introduced. These include semiconductor elements such as Schottky, Gunn, and tunnelling diodes, MESFET, HEMT, and HBT. Fundamentals of microwave tubes are discussed for only a limited number of tube realizations. On the basis of the discussion of the active elements, active circuits are introduced. These include amplifiers, oscillators, and mixers. An overview on antennas is given and aspects of microwave systems are presented. The course finishes with an introduction to aspects of free-space electromagnetic wave propagation.

Prerequisites:	Electronic circuits, fundamentals of electromagnetic fields, Fourier transforms
Examinations:	written
Lecturers:	Prof. Dr. M. Chandra

Electronic Circuits I Electronics / Microelectronics
Elektronische Schaltungstechnik I (page 45)

Electronic Circuits II Electronics / Microelectronics
Elektronische Schaltungstechnik II (page 45)

High Frequency Technology II
Hochfrequenztechnik II
S 2 1 0 5 cr

The course offers a systematic description of the various aspects of microwave and millimetre wave electronics. It provides in-depth discussion of transmission line structures, passive and active components, antennas, and wave propagation in free space. Particular attention is drawn to the characterization techniques of the passive and active microwave circuits. After treating the subject of noise the detailed operational properties of semiconductor devices are covered giving special attention to the latest device developments such as resonant-tunnelling diodes and heterojunction bipolar transistors. Then, the course focuses on the design realization features, and applications of microwave circuits and especially monolithic integrated microwave circuits (MMIC). Amplifiers, oscillators and mixers are described. The design of mixers is facilitated by introducing conversion equations. Finally, aspects of free-space wave propagation are given, with the focus on satellite-ground links and mobile communications.

Prerequisites:	Electronics, communications, semiconductor devices, it is advised to have fundamental knowledge in microwave engineering
Examination:	written, laboratory
lecturers:	Prof. Dr. M. Chandra

Computer Engineering
Rechnertechnik
W 2 1 0 S 2 1 2 13 cr

part 1:
Objective:
Unterstanding of the components, the architecture and organisation principles of computer systems.
Content:
Computer as common components of IT systems
Basic hardware components (processing units, memory and I/O units, control units),
data and number representation,
single-processor system (central processing unit, addressing modes, interrupt system, memory management unit;
multiprocessor and multicomputer systems;
Case studies : Microcontroller I8051 and microprocessorsystem I8086
Program design for real-time applications (processes and multitasking)

Lab work to Assembler programming

part 2:
Objective:
Understanding of the microarchitecture of microprocessors and computer organization
Content:
CISC and RISC concept
Microprogramming
Instruction-level parallelism
Case study of a RISC microprocessor
Superscalar and multiple-issue processors
memory organisation (cache, virtual memory, segmentation and paging).

Prerequisites: Basic courses of Electrical Engineering
Examination: written
Lecturer: Prof. Dr. K. Franke

Digital Systems
Digitale Systeme
W 3 2 0 8 cr

Methods for defining and solving Boolean problems, for the design of unclocked networks and the analysis of linear digital systems are presented. Topics are Boolean differential calculus, design and analysis of circuits with feedback loops, solvability, solubility, solving and uniqueness of Boolean equations, time-spaced Boolean differential equations and their solutions, data structures (lists of ternary vectors, Decision Diagrams) and data exchange formats (BLIF), and D transformation for linear digital signal processing.

Prerequisites: System theory of digital systems
Examination: written
Lecturer: Prof. Dr. R. Barthel

Digital Signal Processing
Digitale Signalverarbeitung
W 2 0 0 S 2 1 0 8 cr

Operations on discrete-time signals; Sampling Theorem; z-Transform (ZT) and methods of reverse transform; classification and topology of discrete-time systems; solving of difference equations, convolution sum; causality and stability of LTI-systems; FIR- and IIR-systems; transfer function as ZT of the impulse response function; signal frequency analysis; Discrete Fourier Transform and Fast FT; ideal and causal frequency-selective filters, linear phase FIR-filter, DFT-based linear filtering, IIR-filter design, Impulse-Invariance Transform and Bilinear Transform;

Prerequisites: System theory
Examination: written
Lecturer: Prof. Dr. R. Barthel

Electronic Measurement Technology Electronics / Microelectronics
Elektronische Meßtechnik (page 50)

System Design
Systementwurf
S 2 0 0 W 1 0 2 8 cr

The complexity of technical systems is constantly growing. Only abstraction, the introduction of hierarchy, and the use of formal description languages for system specification purposes provide the means to tackle the problem of complexity.
Therefore certain design levels and design strategies are described. The hardware description language VHDL will be introduced, its modelling concept will be explained and discussed thoroughly within the associated exercise sessions.
In their laboratory projects students will design a microprocessor, and verify their design by means of test benches and assembler programs to be run on the VHDL model of the processor.

Prerequisites: IC design, computer architecture, digital systems
Examination: oral
Lecturer: Prof. Dr. D. Müller

EDA Tools
EDA-Tools
S 2 0 0 W 1 0 2 8 cr

In order to cope with the growing possibilities of microelectronics, the use of powerful VLSI CAD systems, which are often called „Electronic Design Automation“ (EDA) tools, is a must.
The course starts by giving a sketch of VLSI synthesis at different design levels. Afterwards the course deals with logic (gate) synthesis, including the general synthesis flow and the use of the commercial tool Synopsys. Simple subcircuits, as well as more complex ones such as pipeline multipliers, processor cores, and DSPs, will be synthesized in the exercise and laboratory sessions.
The second part of the course deals with an abstract explanation of the design process and with special aspects, e.g. simulation, timing verification, synthesis of clock nets, module generators, VLSI implementation of computer arithmetic, and design interchange formats.

Prerequisites: IC design, system design
Examination: oral
Lecturer: Prof. Dr. D. Müller

Techniques of Integrated Circuits Electronics / Microelectronics
Integrierte Schaltungstechnik (Page 48)

Data Communications
Datenkommunikation
W 2 0 0 S 2 1 0 8 cr

Objective:
The understanding of the techniques and systems for computer networking
Content:
Communication architecture, ISO Reference Model and standardization, transport protocols, data transmission (transmission media, digital signal transmission basics, baseband transmission systems and digital modulation, synchronization), data link control (error detection and flow control), protocol specification, local area networks (Ethernet, Token-Ring,, LAN bridges), wide area communication (X.25-packet network and frame relay), Gigabit Ethernet.

Prerequisites: Basic courses of electrical engineering
Examination: written
Lecturer: Prof. Dr. K. Franke

Telecommunications II
Nachrichtentechnik II
W 2 1 0 S 2 1 0 10 cr

Part I:
The following topics will be treated: Examples of multivariate systems (MIMO-systems, polarimetry, multichannel variable transmission, …), introduction to one channel and multichannel radar systems, multivariate analytic signals, the monochromatic plane electromagnetic wave description (MEW), the scattering description of MEW via multivariate linear systems, the scattering matrix of reflecting objects, transmission of multivariate signals via multichannel linear systems, description of transmission channels and the antenna, applications (Remote sensing, radar polarimetry, multichannel detection and classification, …).

Part II:
The lecture treats of the basics in estimation theory and fusion of multivariate data: introduction into modelling of vague entities, modelling of vague entities with probabilistic theory, modelling of dynamic systems (state space description), dynamic systems and modelling of disturbances, sensor models (e.g. laser, radar, image), basics in estimation theory, Kalman filtering, Kalman filtering in examples and applications, Kalman filtering for tracking objects (e.g. vehicles, pedestrians), multi Kalman filtering for the simultaneous tracking of several objects, sensor data fusion (e.g. laser, radar, image), extensions and special cases of Kalman filters.

Prerequisites: Basics of electrical engineering, Telecommunications I
Examination: oral
Lecturers: Prof. Dr.-Ing. G. Wanielik / Dr.-Ing. U. Scheunert

Optocommunication Electronics / Microelectronics
Optokommunikation (page 49)

Courses in *Microsystems and Precision Engineering*

subject	Semester 5. V - Ü - P	6. V - Ü - P	7. V - Ü - P	8. V - Ü - P	total V - Ü - P	grand total
Compulsory subjects						
1. Instrument Design	2 - 1 - 0	2 - 1 - 0	0 - 0 - 2		**4 - 2 - 2**	**13**
2. Microsystems		3 - 0 - 0	1 - 1 - 1		**4 - 1 - 1**	**10**
3. Reliability and Quality Assurance		2 - 0 - 0	2 - 1 - 0		**4 - 1 - 0**	**8**
4. Electronic Circuits I	2 - 1 - 0	0 - 0 - 2			**2 - 1 - 2**	**8**
5. Sensors and Sensor Signal processing	2 - 1 - 0	0 - 0 - 2			**2 - 1 - 2**	**8**
6. Materials and Techn. of Microsystems and Devices	3 - 0 - 1	3 - 0 - 1			**6 - 0 - 2**	**13**
Optional requ.subjects						
Block						
1.1 Control Engineering (Microsysytem technology)			2 - 0 - 0	1 - 0 - 2	**3 - 0 - 2**	**8**
1.2 Microprocessor Systems	2 - 1 - 0	1 - 0 - 1			**3 - 1 - 1**	**8**
1.3 Electrical Drives/ Fractional Horsepower Drives		3 - 0 - 0	2 - 0 - 2		**5 - 0 - 2**	**12**
1.4 Technical Optics		2 - 0 - 0	1 - 2 - 0		**3 - 2 - 0**	**8**
1.5 CAD			2 - 0 - 0	0 - 1 - 2	**3 - 0 - 2**	**8**
2.1 Control of Continuous Systems I	3 - 2 - 1				**3 - 2 - 1**	**10**
2.2 Techniques of Integrated Circuits			2 - 1 - 0	0 - 0 - 2	**2 - 1 - 2**	**8**
2.4 ASIC Design				2 - 1 - 2	**2 - 1 - 2**	**8**
2.5 Optoelectronics			2 - 1 - 1		**2 - 1 - 1**	**7**
2.6 Devices of Automation Engineering/ Basics of Robotics	2 - 1 - 0	2 - 1 - 2			**4 - 2 - 2**	**13**
3.1 Industrial Electronics		2 - 1 - 0	0 - 0 - 2		**2 - 1 - 2**	**8**
3.2 Electronic Circuits II		2 - 1 - 0	0 - 0 - 1		**2 - 1 - 1**	**7**
Semester total L - E - P	**16 - 7 - 2**	**22 - 4 - 8**	**14 - 6 - 9**	**3 - 2 - 8**	**55 - 19 - 27**	
studium generale	4 SWS				**4 - 0**	**6**
Semester total L+E+P	**25**	**34**	**29**	**13**	**59 - 19 - 27**	

Instrument Design
Gerätekonstruktion
W 2 1 0 S 2 1 0 W 0 0 2 13 cr

basis and terms, devices assembly (processing, communication and protection function)
protection of the environment and the device with regard to heat emission, electromagnetic compatibility, vibration protection
functional elements in device technology: springs and spring-mass-systems, stops, tensing mechanism, step and jump mechanism
bearing and guides, clutches, damping attenuation, breaks, gears in precision engineering
design methods: systematic, basic principles, analysis, synthesis, evaluation, integration and separation of functions
practical training in special problems
practical course in heat emission, electromagnetical compatibility, vibration protection, rotation-translation-transmission, instrument analysis
project work in teams

Prerequisites: Basic course of electrical engineering
Examination: written
Lecturer: Prof. Dr. W. Dötzel

Microsystems
Mikrosystemtechnik (MST)
S 3 0 0 W 1 1 1 10 cr

The summer term is divided in a basic part (2 0 0) and a modelling/simulation part (1 0 0)
terms and field of microsystem technology
scaling
functional and form elements in micromechanics
working principles
micro sensors, micro actuators
interconnection of micro components with the macro environment (mechanical, thermal, electrical, energetic)
modelling and simulation in micro systems technology,
practical training in special problems
practical course in micro sensors and micro actuators and their applications.

Prerequisites: Basic course of electrical engineering, materials and technologies of MST
Examination: oral
Lecturer: Prof. Dr. W. Dötzel

Reliability and Quality Assurance
Technische Zuverlässigkeit / Qualitätssicherung
S 2 0 0 W 2 1 0 8 cr

evaluation of technical systems, quality, reliability and cost, standards, failure concepts, maintainability of systems
characteristics, calculation examples; lifetime distributions; reliability analysis of systems (Boolean model, equivalent network), serial, parallel and complicated structures
consideration of several failure modes and load modes, fault-tolerant modes (statistical, dynamic and hybrid redundancy), tolerance and drift analysis (worst-case and statistical procedure), examples
reliability tests (goal, statistical basis, test schedules, parameter estimation, hypothesis tests, accelerated tests)
quality assurance -DIN ISO 9000, QA tools (quality charts, FTA, FMEA), guidelines of a reliability oriented design

Prerequisites: Basic course of electrical engineering
Examination: written
Lecturer: Prof. Dr. W. Dötzel

Sensors and Sensor Signal Processing Automation & Control Engineering
Sensoren und Sensorsignalauswertung (page 33)

Electronic Circuits I and II Electronics / Microelectronics
Elektronische Schaltungstechnik I and II (page 45)

Materials and Technologies* of Microsystems and Devices
Werkstoffe und Technologien der Mikrosystem- und Gerätetechnik
W 3 0 1 *S 3 0 1 13 cr
A first a short introduction reviews the special demands on materials in technologies of microsystems and devices. Next the basic knowledge is explained for production process of mono- and polycrystalline materials, glasses and polymers (crystal growth, purification, casting, sintering, deformation, synthesis) with regard to the result properties. It follows the application of semiconductors, metals, glasses, ceramics or polymers as construction materials (substrates, wires, solders, adhesives, castings, coatings). Because of the importance of crystal properties the explanation of their tensor representation and of crystal symmetries (matrices of transformation and stereographic projection) follows. The functional materials of transducers (transformation of thermal, mechanical, magnetic, optical or chemical energy in electrical energy and vice versa) are discussed in the last part of lectures.
Subjects of the practics are: elastic constants of the silicon monocrystal, properties of silicon wafers (crystallographical, geometrical and electrical properties), dielectric properties of glasses, ceramics and polymers.
* summer semester: (page 49), microtechnologies *(Mikrotechnologien)*,

Prerequisites: Materials of electrical engineering
Examination: written
Lecturers: Prof. J. Frühauf / *Prof. Dr. T. Gessner

Control Engineering (Microsystem Technology)
***Prüftechnik* (*Mikrosystemtechnik*)**
W 2 0 0 S 1 0 2 8 cr

Non tactile methods for measurement of geometric properties of micro structures (3-dimensional surface topography) based on interferometric and focus detection instruments and triangulation;
experimental methods for characterising the behaviour of micro mechanical devices;
electrical and mechanical excitation of micro structures;
detection of displacements by focus measuring and using a Doppler-interferometer;
signal analysis by statistical methods;
calculation of frequency response functions, natural frequencies and damping;
analysis of the oscillation mode shapes;
experimental estimation of model parameters and simulation on the base of experimental advanced models of similar micro structures;
two channel analysis, Fast Fourier Transformation, principles of modal analysis;
modification and simulations by means of the modal dynamical model;
Practical course: methods for measurement of geometric properties of micro structures.

Prerequisites: Basic course of electrical engineering, micro system technology
Examination: written
Lecturers: Dr. J. Markert / Dr. J. Mehner

Microprocessor Systems Automation & Control Engineering
Mikroprozessorsysteme (page 33)

Electrical / Fractional Horsepower Drives
Elektrische / Gerätetechnische Antriebe
S 3 0 0 W 2 0 2 12 cr

The first part (SS 3 0 0) is equal to the lecture „Electrical drives“, the second part (WS 2 0 2) deals with „Fractional horsepower drives“.
fields, demands, development trends in fractional horsepower drives;
descriptions, signal- and powerstream in electrical drives;
mechanical drives, potential und kinetic energy stores;
DC and AC electromagnets, oscillating armature motors;
DC motors, electronically commutated (EC) motors;
small induction motors;
stepping motors: constructions, moments, forces, positioning accuracy, microstep, selection technique, power converters, linear stepping motors, dynamic;
unconventionally drives: piezoelectrical, electrorheological, magnetostrictiv, shape memory actuators, thermal bimetals, DC linear motors, multicoordinate-drives;
device-dynamic: objective target, modelling, determine of system parameters;
Practical course: parameters und application conditions of fractional horsepower drives.

Technical Optics
Technische Optik
S 2 0 0 W 1 2 0 8 cr

working area of optics, Fermat´s principle;
reflection and refraction of light, identification of optical glasses, achromatic prism;
picture generation by spherical lens and lens systems;
limitation diaphragm, pupils of optical devices with lighting equipment, depth action, telecentric optical path;
prism, beam transmission;
spherical aberration, sinus condition, astigmatic and field curvature, coma, distortion, chromatic colour aberration, radiation and lighting;
characteristics, light flux, and illuminance;
practical training in special problems.

Prerequisites: Basic course of electrical engineering
Examination: written
Lecturer: Dr. B. Küttner

Basics of Robotics Automation & Control Engineering
Grundlagen der Robotik (page 32)

Computer Aided Design
CAD
W 2 0 0 S 0 1 2 8 cr

This course introduces computer-aided methods for 3-dimensional structural modelling, generation of technical draftings and fundamentals of numerical analysis and simulation of engineering problems.
CAD-hardware architectures, techniques of geometrical modelling;
geometry handling and data management;
computer graphics and data presentation;
matrix methods for static and dynamic simulations;
shape function methods for analysing continuous systems (Collocation method, Galerkin approach);
engineering methods and tools for design and simulation (FDM, FEM, BEM).
The lectures are accompanied by practical training using the CAD-software PRO/ENGINEER and the general purpose Finite Element Toll ANSYS.

Prerequisites: Basic course of electrical engineering
Examination: oral
Lecturers: Dr. J. Mehner

Control of Continuous Systems I Automation & Control Engineering
Eingrößenregelung (page 34)

Techniques of Integrated Circuits Electronics / Microelectronics
Integrierte Schaltungstechnik (page 48)

Industrial Electronics Automation & Control Engineering
Industrielle Elektronik (page 37)

ASIC Design
ASIC-Entwurf
S 2 1 2 **8 cr**

This course focuses on the various issues of designing application-specific integrated circuits (ASICs), which play an important role in modern microelectronics.
Hence the basic concepts of user-programmable and mask-programmable ASICs are imparted. The architectural features of PLDs, FPGAs, gate arrays and standard cells are covered. The lecture provides a survey of the general ASIC design flow and deals with certain aspects of functional and structural design, e.g. modelling, synthesis, simulation, and test issues.
Students will consolidate their knowledge in laboratory sessions, where they are to work on their own projects.

Prerequisites:	Electronic devices and circuits, circuit technology
Examination:	oral
Lecturer:	Prof. Dr. D. Müller

Optoelectronics Electronics /Microelectronics
Optoelektronik (page 46)

Devices of Automation Engineering Automation & Control Engineering
Geräte der Automatisierungstechnik (page 32)

D. Optional Courses (*Wahlfächer*)

The optional courses / classes are listed below for information only.

subject	weekly working hours	
	WS	SS
Seminar Systemwissenschaften	1 0 0	1 0 0
Regelungen in der Energietechnik		2 0 0
Netzberechnung		2 0 0
Energie und Umwelt		2 0 0
Design und Technologie von Leistungshalbleitern		3 0 0
Digitale Schutz- und Leittechnik	2 1 0	
Betriebsmittel der Elektroenergieversorgung	2 0 0	
Diagnose- und Messtechnik		2 0 0
Elektroenergiewirtschaft		1 0 0
Traktions- und Magnetlagertechnik		2 0 0
Mikrosystementwurf		2 1 0
Technologisches Komplexpraktikum	0 0 4	
Halbleitermesstechnik		2 1 0
Neue Bauelementetechnologien	2 1 0	
Netzwerksimulation	2 0 0	
Verfahrens- und Prozessmodellierung der Bauelementetechnologie	2 1 0	
Integrierte Optik	2 0 2	
Entwurfsautomatisierung		2 0 0
Mathematische Grundlagen der Digitaltechnik		2 0 1
Bildkommunikation / Bildverarbeitung	2 0 0	2 0 4
Logikentwurf		3 2 0
Entwurfspraktikum		2 0 2
Digitale Kommunikationssysteme / Multimediakommunikation	2 0 0	
Mikrocontroller / Digitale Signalprozessoren	1 1 2	
Quantentheorie für Mikroelektroniker	2 0 0	

E. General Studies (studium generale)

The following offers of non-technical subjects, for the basic and main courses, come from the faculties of Economics and Humanity. They are listed for information only.

Subject :

* Company invoice and controlling	*Unternehmensrechnung und Controlling*
* Environment law	*Umweltrecht*
* Finance and investment	*Finanzierung und Investition*
* Marketing and sales	*Marketing und Vertrieb*
* Production economy / Industrial works apprenticeship	*Produktionswirtschaft / Industriebetriebslehre*
* Public law	*Öffentliches Recht*
* History of Technology	*Geschichte der Technik*
* Philosophy of engineering	*Technikphilosophie*
* History of computer techniques / Information sciences	*Geschichte der Computertechnik / Informatik*
* Culture and Technology	*Kultur und Technik*
* Introduction to the sociology of industry	*Einführung in die Industrie- und Techniksoziologie*
* Outline of sociology	*Grundzüge der Soziologie*
* Introduction to sociology	*Einführung in die Soziologie*
* Social psychology	*Sozialpsychologie*
* Accounting for non management experts	*Rechnungswesen für Nichtbetriebswirte*
* Labour sciences	*Arbeitswissenschaften*
* Personnel management apprenticeship for non management experts	*Personalführungslehre für Nichtbetriebswirte*
* Organisation law and building law	*Planungs- und Baurecht*
* Technology assessment / Environmental breeding	*Technikfolgenabschätzung / Umwelterziehung*
* Organisation engineering	*Technikgestaltung*
* Intercultural communication	*Interkulturelle Kommunikation*
* Industry marketing	*Industriemarketing*
* Marketing and sales science for non management experts	*Marketing und Absatzwirtschaft für Nichtbetriebswirte*
* Business Politics	*Wirtschaftspolitik*
* Civil law for engineer	*Zivilrecht für Ingenieure*
* Labour law and social law	*Arbeits- und Sozialrecht*
* Energy and environment	*Energie und Umwelt*
* Quality management	*Qualitätsmanagement*