

UNIVERSITY OF DEBRECEN
FACULTY OF INFORMATICS



BSc degree courses
MSc degree courses
PhD courses

Research

Computer Science Engineering BSc



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Foreword by the Dean

Dear Reader,



We are introducing here the Faculty of Informatics at the University of Debrecen. Our faculty is new, having been established in 2004 as a result of a long process of organic growth. The teaching of information technology began in 1972 at the Kossuth Lajos University, one of the predecessors to the University of Debrecen, when 29 students enrolled for studying a particular part of mathematics called software engineering. Today, some of those first students are highly respected instructors at the Faculty. In 1972, the Computer Science Department was established as a sub-division of the Institute of Mathematics, with a teaching staff of seven instructors, later in 1994 the Department of Information Technology. The pace of change has been breathtaking over the past decades, especially in the field of information technology. The computer has

become a common household object. Today, computers and software are not only integral elements of companies' managements and civil administrations, but have become an inseparable part of our everyday lives, and the Internet gives us virtually instantaneous access to an almost limitless pool of information.

The changes undergone by society have not left our University unaffected either. Indeed, they have been one of the driving forces behind our growth. The numbers of IT students, instructors and departments, have been multiplied, and the range of courses we offer has also expanded. At the end of the 1980s, we began providing university-level education in software engineering, IT Teaching and Library IT. We have also played an active role in the founding and running PhD School of Informatics. Today, six departments of the Faculty employ a total of 70 instructors, who are supported in their work by the Dean's Office, the Systems Administration Group and the special library, which is shared with the Institute of Mathematics, Faculty of Natural Science. The Faculty of Informatics currently has more than 2,300 students.

The formation of our Faculty has coincided with implementation of the Bologna process, which has fundamentally determined the direction for future development of higher education in Hungary. We have successfully completed accreditation of the basic specialisations, and in 2004 we were the first institution in Hungary to offer a degree in Software Engineering BSc. In 2005 we launched the System Engineering BSc course, and from 2006 we are running Business Information Management BSc and Library Information Management BSc courses. The curricula of the master's degree courses have also been formulated, with the assistance and cooperation of several other faculties: the Faculty of Economics and Business Administration, the Faculty of Technical Engineering and the Faculty of Sciences. After gaining their master's degrees, our students also have the opportunity to study for their PhD at the PhD School of Informatics, or at Mathematics and Computer Sciences PhD School.

The Faculty of Informatics fulfils an important role with regard to higher education and scientific research in the region. Our instructors have decades of experience in training IT professionals to internationally recognised standard. We consider it a key priority to cooperate with local industry and service providers. We aim to ensure that specialists who graduate from Debrecen do not feel compelled to pursue a career elsewhere, but that as many as possible are able to find employment in the region. To this end we have initiated the Debrecen InfoPark, the "Szilícium Mező" and other important projects like "FUTURE INTERNET", and work as closely as possible with local enterprises.

Sincerely,

Dr. Tamás Mihálydeák, Dean

University of Debrecen



The University of Debrecen, like other integrated institutions of higher education in Hungary, was formed, on 1 January 2000, through the (re)merging of several hitherto autonomous institutions. Its historical roots stretch back to the foundation of the Reformed College of Debrecen (1538), the three academic sections of which later served as the foundation for the Hungarian Royal University of Sciences,

created by Statute XXXVI of 1912. This makes the University of Debrecen, with its uninterrupted 450-year history, the oldest institute of higher education in the country to have operated continuously in the same town. Higher education in agriculture began in 1868, when the National Higher School of Agriculture was formed in Debrecen.

With a student body of 30,000 and a 1,700-strong teaching staff, the University of Debrecen is without a doubt one of the largest higher-education institutions in the country, and with its 15 faculties, two independent institutes and 25 doctoral schools (both these figures are highest in the country), it also offers the widest range of educational and research opportunities.

The quality of teaching, and especially of research, is illustrated by the fact that more than half the instructors have a doctorate, and 23 are full or corresponding members of the Hungarian Academy of Sciences. According to the results of the Ministry of Education's annual complex performance report (which serves as the basis for allocating performance-related research funding), the University is the best institution outside of Budapest, and among the top three institutions in the country in terms of research performance, accounting for around 14-15% of the country's overall research volume.

This outstanding centre of academic excellence, with its vast educational and R+D capacity, is an increasingly important factor influencing the economic and social development, and the cultural progress, of the region. It devotes special attention to serving the needs of a knowledge-based economy, and fulfilling the role of a regional knowledge centre. UD is one of the five Hungarian universities that have been awarded the prestigious 'research university' title by the Ministry of Education.

Information: <http://www.unideb.hu/portal/en>

Faculty of Informatics



The **Faculty of Informatics** at the **University of Debrecen** boasts the only accredited university-level educational program for IT specialists in the east-Hungarian region. The six professors, 19 associate professors (senior staff), 29 assistant professors (staff), 16 teaching assistants and 5 graduate computer scientists working at the faculty's seven departments (Department of Applied Mathematics and Probability Theory, Information Technology, Computer Graphics and Image Processing, Library

Informatics, Informatics Systems and Networks, Computer Science, Affiliated Department of ICT Systems Operation), represent a formidable pool of intellectual potential, which has earned recognition even at international level.

The aim of the Software Information Technology (Software Engineering), Engineering Information Technology and Business Information Technology majors is to produce IT professionals who possess the complex vocational and theoretical skills needed to scientifically model the practical problems that they will face in the course of their day-to-day work, and to identify and respond to them by selecting or developing the appropriate solutions. Students who graduate from these courses will be capable of supervising teams of specialists assembled for the purpose of performing these tasks, and will possess the basic theoretical, methodological and linguistic skills to conduct research in their chosen field.

The number of students at the faculty increased till 2010. There are currently around 2,000 students studying the specialisations in Hungarian. We started to teach our courses in English in 2007, the number of students is growing year by year.



Number of Students at Faculty of Informatics

Computer equipment at the Faculty



In August of 2011 our Faculty moved to a modern, new building. In this building there are 3 large lecture halls, 8 seminar rooms and 11 well equipped computer laboratories with 195 computers and workstations.

The data network

The building is equipped with a high-speed data network constructed from CAT6a AMP S/FTP cabling with a bandwidth of 10 Gbps. The cables run from 1092 end-points to converge in six rack cabinets. The bulk of data traffic is controlled by 10 Gbit manageable network switches, which are in turn linked via 2*10 Gbps SM connection to a central switch, which connects to the University's backbone at 2*10 Gbit/s.

The building is covered by EDUROAM wireless network, which is servicing the staff and students' requirements.

All computer laboratories are equipped by overhead projectors and we have some mobile projectors too. Some of the machines are connected to peripherals such as multifunctional devices, printers and scanners, to further assist the staff and students in their work. The pool of computer equipment used by staff and students is constantly being improved and upgraded.



Library



The University and National Library University of Debrecen (UNL) was established January 1, 2001 as a result of the university integration with the union of the libraries of the predecessor institutions.

The seven library units of the UNL (see *Libraries*) can be found on the five campuses of the university.

The two main parts of the UNL holdings include the legal deposit collection and the *scientific* collection supporting the educational, research and medical work of the university. The holdings divided among seven research libraries (the Agricultural Science Library, the Arts and Sciences Library, the Kenézy Life Sciences Library, the Engineering Library, the Library of the Faculty of Education, the Social Sciences Library, and the Library of the Conservatory) are available for the employees and students of the University and for the citizens of Debrecen. The collections of the related fields are complemented with valuable special collections.

The largest proportion of the valuable collection of the library (more than 2.700.000 documents) comprises of books and bound periodicals. The digital periodical collection is also significant; with the help of this our users are able to access more than 27.000 periodicals. Above these more than 100.000 music scores, audio files (30.681), images (2874), cartographic materials and other types of documents are available for the users.

Besides the so called traditional services like reading room or circulation the University and National Library provides users with numerous modern services. A major part of the electronic services are available for our users in any part of the world.

The Library collects and manages information on the scientific products of the University of Debrecen. The full texts of the publications are maintained in the University of Debrecen Electronic Archive (DEA).

BSc Degree Courses

Computer Science

Aim of the course:

To train IT professionals who, possessing the solid theoretical grounding necessary to further develop their skills over the long term, are capable of performing, at an advanced level, the typically *software-oriented* development, implementation and servicing tasks related to IT equipment and systems, working either independently or as part of a team. Participants in this course will also learn the interaction and modelling skills required to solve IT tasks in all the main areas of application.

Length of course

- Number of semesters: 6.
- Total hours (total student study time): min. 5,400 hours, of which the number of teaching (contact) hours: min. 1,800.
- Number of credits required to obtain degree: 180.

Language: Hungarian, English

Computer Science Engineering

Aim of the course:

To train IT engineers who have the IT-related skills needed to plan, develop and service technical installations that utilize IT-based solutions, especially with regard to technical IT and IT infrastructure systems and services, as well as their data and software systems, and who have assimilated the practical engineering techniques associated with the installation and commissioning of IT infrastructure.

Length of the course

- Number of semesters: 7
- Total hours (total student study time): min. 6,300 hours, of which the number of teaching (contact) hours: min. 2,100
- Number of credits required to obtain degree: 210

The differentiated compulsory vocational subjects and optional vocational subjects are grouped into specialisations. Students who select a particular specialisation may only obtain the compulsory 40 credits from subjects associated with their chosen specialisation.

Language: Hungarian, English

Specialisations:

Info-communication networks (English)
Measurement and process management
Corporate IT systems

Business Informatics

Aim of the course:

To train IT professionals who are capable of understanding and resolving the specific business processes underlying the information-based society, managing the IT tasks that support value-creating processes, and, making the best use of the opportunities presented by modern information technology in order to increase the knowledge base and business intelligence of organisations, to model processes based on interaction between information communication processes and technologies, to regulate and plan processes, identify problems, define problem areas, develop and operate applications, and monitor their operation in accordance with the requisite quality standards. Graduates will also possess the depth of theoretical knowledge necessary to continue their training in the second cycle.

Length of the course

- Number of semesters: 7
- Number of teaching (contact) hours: 2,450
- Number of credits required to obtain degree: 210

Language: Hungarian, English

Specialisations:

Corporate management
E-business

Library and Information Science

Aim of the course

The aim of the Library Information Technology course is to train highly qualified specialists with a knowledge of the latest library and information science theory, as well as the skills required for its practical application, including information management and the methodology of research in this field.

Length of course:

- Number of semesters: 6
- Number of credits required to obtain degree: 180
- Number of teaching (contact) hours: 2.250
- Compulsory vocational practice: 120 hours after the second semester and 220 hours in the 5-6th semesters.

Language: Hungarian

Specialisation:

Web programmer
Public library

Master's Degree Courses

Computer Science

Aim of the course:

To train IT professionals who, possessing the solid theoretical grounding necessary to further develop their skills over the long term, are capable of performing, at an advanced level, the typically *software-oriented* development, implementation and servicing tasks related to IT equipment and systems, working either independently or as part of a team. Participants in this course will also learn the interaction and modelling skills required to solve IT tasks in all the main areas of applications. Graduates will also possess the depth of theoretical knowledge necessary to continue their studies in PhD Schools.

Length of course:

- Number of semesters: 4
- Total hours (total study time): 3,600, of which the number of contact hours: 1,200.
- Number of credits required to obtain degree: 120

Language: Hungarian, English

Specialisations:

1. Healthcare IT management
2. Information management systems
3. Information systems
4. Image processing and computer graphics
5. Artificial intelligence
6. Computer science

Business Informatics

Aim of the course:

To train IT professionals who are capable of understanding and resolving the specific business processes underlying the information-based society, managing the IT tasks that support value-creating processes, and, making the best use of the opportunities presented by modern information technology in order to increase the knowledge base and business intelligence of organisations, to model processes based on interaction between information communication processes and technologies, to regulate and plan processes, identify problems, define problem areas, develop and operate applications, and monitor their operation in accordance with the requisite quality standards. Graduates will also possess the depth of theoretical knowledge necessary to continue their training in PhD Schools.

Length of the course

- Number of semesters: 4
- Total hours (total study time): 3,600, of which the number of contact hours: 1,200.
- Number of credits required to obtain degree: 120

Language: Hungarian

Specialisations:

- Informatics for Business Administration
- Economic Modelling
- Informatics for Public Sector
- Informatics for Rural Development

Computer Science Engineering

Aim of the course:

To train IT engineers who have the IT-related skills needed to plan, develop and service technical installations that utilize IT-based solutions, especially with regard to technical IT and IT infrastructure systems and services, as well as their data and software systems, and who have assimilated the practical engineering techniques associated with the installation and commissioning of IT infrastructure.

Length of the course

- Number of semesters: 4
- Total hours (total student study time): min. 3,600 hours, of which the number of teaching (contact) hours: min. 1,200
- Number of credits required to obtain degree: 120

The differentiated compulsory vocational subjects and optional vocational subjects are grouped into specialisations. Students who select a particular specialisation may only obtain the compulsory 40 credits from subjects associated with their chosen specialisation.

Language: Hungarian

Specialisations:

Info-communication networks (English)
Hardware programming

Library Information Sciences

Aim of the course

The aim of the Library Information Technology course is to train highly qualified specialists with a knowledge of the latest library and information science theory, as well as the skills required for its practical application, including information management and the methodology of research in this field.

Length of course:

- Number of semesters: 4
- Number of credits required to obtain degree: 120
- Number of teaching (contact) hours: 1200

Language: Hungarian

Teacher – Teacher of Informatics



Teacher – Teacher of Library-pedagogy



PhD School of Informatics

Head of the School: Dr. Attila Pethő, DSc, full professor

Programs:

- Discrete mathematics, image processing and computer graphics (Director: Prof. András Kruppa)
- Theoretical basis and applications of the information technology and the stochastic systems (Director: Prof. István Fazekas)
- Theoretical computer science, data security and cryptography (Director: Prof. Attila Pethő)
- Information technology systems and networks (Director: Prof. János Sztrik)
- Applied IT and its theoretical background (Director: Prof. György Terdik)
- Industrial and scientific applications of the informatics (Director: Prof. Gábor Halász)

Length of the program: 6 semesters

The staff of the IT Faculty also plays an important part in the work of the Mathematics and Computer Science PhD School, which runs 9 programs.



CISCO Regional Academy



Computer networks appeared 20 years ago as a standalone and well separated topic of computer science studies. After some years of teaching networking it could be discovered, that the theoretical and practical topics covered in the “Computer networks” course are not fully adequate and not specialized to the workplace market requests. At this point (in 1999) the Cisco Networking Academy Program appeared in Hungary, and it was recognized, that introducing the CNAP into the teaching would help the students in solving computer networking problems, so their knowledge will be much more closer and adequate to the workplace market requests. University of Debrecen was the first university in Hungary, who joined to the Cisco Networking Academy Program as a Regional Academy in 1999.

Following the so called “Bologna’ Process” structure, two levels (Bachelor and Master level) higher education appeared in the computer science teaching, too. In 2004 the bachelor courses of “Computer Engineering” were accredited and started at the Faculty. The Computer Engineering contains three kind of specialization direction, including the “Communication technologies”. The CCNA courses are offered for the students of the “Communication technologies” direction as a “direction mandatory course”. The CCNA courses take high number of lectures, practical and labor studies: two semesters, 120 hours per semester. Usually there are two groups for full-time students (10-16 students per group), and one group for part-time students. The clear aim of the CCNA courses is to get theoretically and practically strong and deep internationally accepted level of networking knowledge for the students.



The most important and most interesting parts of the CCNA courses are the practical and labor lessons. The study catalogs show, that almost 100 percent of the students are present on all of the labors. Students work in a team to solve different configuration and error detection/correction labor tasks during the semester. We recognized the high students’ interest for the laboratory work, and also it was clear to see, that the equipment (router and switch) usage of the Cisco laboratory is very low (only 30-40 hours per week). In order to

solve this “bottleneck problem”, a software system was developed, which opened the possibility for the students to use the equipments of the Cisco laboratory from home (according to a well prepared scheduling). The remote access system works perfectly since 2005, and it has duplicated the usage ratio of our laboratory equipments.

Each student must solve a quite complicated practical exam at the end of the semesters (applying a 3 hours time limit), which needs very strong and deep knowledge both on the theoretical and practical fields. As a result, 50-60 percent of the students successfully pass the international VUE CCNA (640-802) exam for the first trial. This ratio is one of the highest in the Hungarian Cisco Academies, but it is very high in the international context too.

The faculty would like to increase further the networking knowledge of the informatics professional students, so a CCNP teaching environment was established (certified instructors, equipments, etc.), and the CCNP courses for students were started in February of 2010.

In 2009 the Faculty of Informatics University of Debrecen won the “Academy of Excellence” award (the winning process of this award is based on objective measurement numbers/facts of the last years’ performance; actually only two universities were able to reach this level).



CNAP technical background: More than 20 Cisco routers dedicated for the CNAP laboratory (mainly of type 28xx); more than 10 Cisco switches dedicated for the CNAP laboratory (mainly of type 2960).

Research

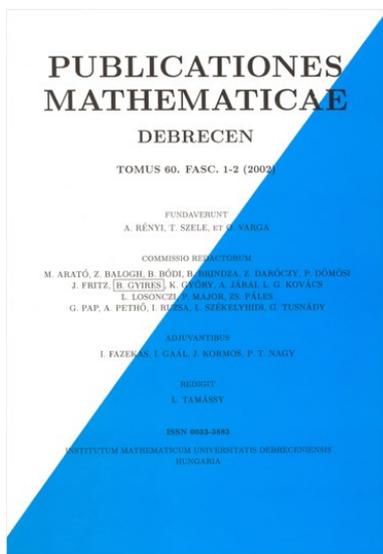
The scientific research conducted at the Faculty of Informatics has steadily broadened in scope and increased in depth over the past decades. Our international reputation for excellence has been further strengthened by the work of our leading scientists in the following areas: stochastic processes and modelling, multivariable statistics, time line analysis, business mathematics, queuing and mass service theory, numerical mathematics, operation research, system theory, databases and information systems, system management, software technology, computer graphics, computerised image processing, form recognition, efficiency studies, quality assurance, code theory, decision theory, computerised text processing and linguistics., formal languages and systems, artificial intelligence, computational number theory, computer algebra, cryptography, statistical inference of stochastic processes and random fields applications of statistics.

Besides the considerable financial contribution made by the Faculty itself, the OTKA, FEFA, OMFB, TEMPUS and other (NKFP, IKTA) subsidies that have been awarded continuously since 1986 play a key role in funding the research.

A number of successful research and development projects have already been based on intensive international cooperation, closely related to specific areas of application. The researchers working on these projects are always prepared to cooperate with local and international partners in order to achieve further results and develop new dedicated applications. Besides the unwavering commitment of the senior staff, the following factors are also highly conducive to the formation of cooperative partnerships of this nature:

- the specialist library, containing more the 25,000 volumes, run jointly with the Institute of Mathematics
- the well-structured institutional LAN, which links around 300 personal computers and contains several hardware and software platforms (Sun Sparc, INTEL, RS6000, Unix, Microsoft, Novell), and which is connected to the internet via a high-speed datalink
- the research team's wealth of experience in international projects, cooperation, and project management
- the involvement of high numbers of outstandingly capable information technology students in the actual (software) development work, through the formation of development teams headed by talented young members of staff.

Periodicals

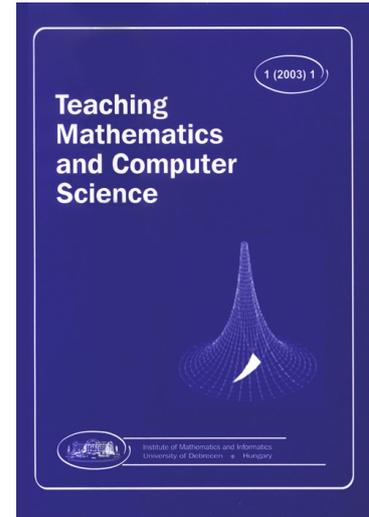


Publicationes Mathematicae Debrecen

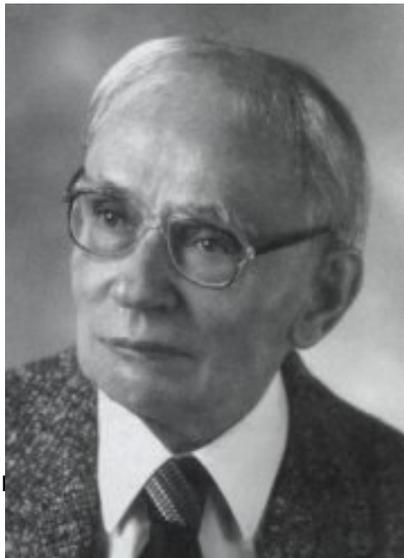
The journal appears quarterly and publishes original research papers on pure mathematical topics. It welcomes contributed papers that develop interesting, or important, new mathematical ideas and results or solve outstanding problems. All papers are refereed for correctness and suitability for publication. Publicationes Mathematicae Debrecen is covered by the Mathematical Reviews, the Zentralblatt der Mathematik, the Science Abstracts and the Science Citation Index.

Teaching Mathematics and Computer Science

The aim of this journal is to publish high quality papers on teaching and education in two fields: Mathematics and Computer Science. Papers are expected to deal with issues related to classroom activities or any other aspect of educational work in one of these fields. Contributions can be concerned with problems relevant to all types of schools, running from elementary schools to universities. Papers should be written mainly in English, but also in French or German, with an abstract in English.



The Béla Gyires IT Lectures



at

Béla Gyires (1909-2001) was a key personality at the Mathematics and Information Technology Institute of the Kossuth Lajos University of Science, which was a predecessor to the University of Debrecen. For many years he was director of the institute. He founded, and headed for 30 years, the Department of Probability Calculation and Applied Mathematics. It was under his direction that the Computing Centre was formed in 1967. He was instrumental in ensuring that subjects as important and modern as probability calculation, mathematical statistics, computer science and information technology were incorporated into the university's curriculum. In 1972, it was at his instigation and under his direction that the courses in Programming Mathematics were introduced. He was the highly regarded mentor of generations of mathematics students.

In his honour, the Béla Gyires IT Lectures are held once a year. At the event, each department of the Faculty gives a presentation of its research activities, in the form of a scientific lecture.



Departments

Department of Applied Mathematics and Probability Theory

Head of Department: Dr. habil István Fazekas, Full professor

Email: fazekas.istvan@inf.unideb.hu

www: <http://w1.inf.unideb.hu/en/web/alkalmazott-matematika-es-valoszinusegszamitas-tanszek/home>

Research fields

- Probability theory
 - Mathematical statistics
 - Operation research
 - Numerical mathematics
 - JAVA technology
 - Statistical inference of stochastic processes and random fields
 - Applications of statistics.
-

Department of Informatics Systems and Networks

Head of Department: Dr. János Sztrik, Full professor

Email: sztrik.janos@inf.unideb.hu

www: <http://w1.inf.unideb.hu/web/informatikai-rendszerek-es-halozatok-tanszek>

Research fields

- Performance evaluation of information systems
 - Queueing systems
 - Stochastic modeling of computer architectures and networks
 - Reliability investigation of complex systems
 - Stochastic simulation
-

Department of Information Technology

Head of Department: Dr. habil Márton Ispány, Associate professor

Email: ispany.marton@inf.unideb.hu

www: <http://w1.inf.unideb.hu/en/web/informacio-technologia-tanszek/home>

Research fields

- Mathematical models and statistical studies of systems
 - Combinatorial coding theory
 - Pattern recognition, image processing, discrete mathematical methods and their application
 - Object-oriented technologies and beyond, database systems, web modelling, software analysis
 - Quantum chemistry and atom physics calculations
 - Computer-aided applied linguistic research
 - Didactic questions related to the teaching of information science
 - Other developments and applications
-

Department of Computer Science

Head of Department: Dr. habil György Vaszil Associate professor

Email: vaszil.gyorgy@inf.unideb.hu

www: <http://w1.inf.unideb.hu/en/web/szamitogeptudomanyi-tanszek/home>

Research fields

- Mathematical logic, modal and intensional logic, type-theory logic, partial logic, formal semantics, temporal logic, logical philosophy, automated theorem proving
- Operation research
- Artificial intelligence, expert systems, knowledge depiction, descriptive logics
- Formal languages and automata
- Multi-modal man-machine relationship, skeletonization algorithms, Support Vector Machine, face recognition, neighborhood sequences
- Neighborhood sequences, digital geometry
- Linear recursive sequences, random number generators
- Cryptography, computer algebra

Department of the Computer Graphics and Image Processing

Head of Department: Dr. habil András Hajdu Associate professor

Email: hajdu.andras@inf.unideb.hu

www: <http://w1.inf.unideb.hu/en/web/komputergrafika-es-kepfeldolgozas-tanszek/home>

Research fields

- Linear mappings
 - Descriptive geometry, cyclographic mapping, central-axonomerty
 - Application of artificial neural networks in computer graphics
 - Free-form modelling
 - Geometric correction of digital images
 - Applied mathematical methods in dentistry
-

Department of Library Informatics

Head of Department: Dr. habil Attila Gilányi, Associate professor

Email: gilanyi.attila@inf.unideb.hu

www: <http://w1.inf.unideb.hu/en/web/konyvtarinformatika-tanszek/>

Research fields

- Information Supply for Teachers
- Project-based Learning Processes
- New trends in Library Education
- Hypertext and Hypermedia Applications
- Using Concordances in the Interpretation of Library Texts
- Automated Libraries
- Integrated Library Information Systems
- MARC Standards, New Medias and Electronic Documents
- Formats of International Data Exchange
- Electronic Libraries

Affiliated Department of ICT Systems Operation

Head of Department: András Harman

Email: Andras.Harman@t-systems.com

www: <http://www.it-services.hu/?lang=en>

Computer Science Engineering

Aim of the course: To train IT professionals who, possessing the solid theoretical grounding necessary to further develop their skills over the long term, are capable of performing, at an advanced level, the typically software-oriented development, implementation and servicing tasks related to IT equipment and systems, working either independently or as part of a team. Participants in this course will also learn the interaction and modeling skills required to solve IT tasks in all the main areas of application.

Length of course

Number of semesters: 7.

Total hours (total student study time): min. 6,300 hours, of which the number of teaching (contact) hours: min. 2,100.

Number of credits required to obtain degree: 210.

	Credits
Natural Science and basic vocational training	111
Economical and human knowledges	20
Specialization	40
Optional subjects in profession	14
Other optional subjects	10
Thesis	15
Total	210

The grade of diplom will be calculated from the final grade for the state exam and the grade of the next subjects:

- INHK313 Hardware Programming 1
- INHK721 Computer Network Architectures and Protocols

Natural Science and basic vocational training

Code	Subject	Credit	Hrs per week			Exam	Prere- quisites	Period	Semester
			Th.	Practice					
				CR	CL				
INHK103E INHK103G	Discrete Mathematics 1	5	2	2		K	INHK103G*	1	1
INHK111E INHK111G	Calculus 1	5	2	2		K	INHK111G*	1	1
INHK201E INHK201L	Introduction to Informatics	5	2		2	K	INHK201L*	1	1
INHK401E INHK401G	Logic in Computer Science	5	2	2		K	INHK401G	1	1

INHK801E INHK801G	Physics 1	4	2	1		K	INHK801G*	1	1
INHK811E	Electronics 1	3	2			K		1	1
INHK112E INHK112G	Calculus 2	5	2	2		K	INHK111E INHK112G*	2	2
INHK421E INHK421G	Data Structures and Algorithms	5	2	2		K	INHK201E INHK421G*	2	2
INHK301E INHK301L	Programming Languages 1	5	2		2	K	INHK201E INHK301G*	2	2
INHK211E INHK211L	Operating Systems	5	2		2	K	INHK201E INHK211L*	2	2
INHK803E	Physics 2	3	2			K	INHK801E	2	2
INHK812E	Electronics 2	3	2			K	INHK811E	2	2
INHK831E	Digital Technologies	3	2			K	INHK811E	2	2
INHK302E INHK302L	Programming Languages 2	5	2		2	K	INHK301E INHK302L*	1	3
INHK501E INHK501L	Database Systems	5	2		2	K	INHK301E INHK501L*	1	3
INHK121E INHK121G	Probability Theory and Mathematical Statistics	5	2	2		K	INHK112E INHK121G*	1	3
INHK821E	Signals and Systems	3	2			K	INHK111E	1	3
INHK721E INHK721L	Computer Network Architectures and Protocols	5	2		2	K	INHK301E INHK211E INHK721L*	1	3
INHK813L	Practice in Electronics	1			1	P	INHK812E INHK831E	2	4
INHK321L	Introduction to LabView Programming	3	0		2	P	INHK302E	2	4
INHK311E INHK311L	Hardware Programming 1	5	2		2	K	INHK302E INHK311L*	2	4
INHK441E INHK441G	Introduction to Artificial Intelligence	5	2	2		K	INHK302E or (INHK301E INHK401E) INHK441G*	2	4
INHK511E	Enterprise Information Systems	3	2			K	INHK201E	2	4
INHK521E	Modelling and Analysis of Information Technology Systems	3	2			K	INHK121E	2	4
INHK451E	Foundation of Computer Security	2	2			K	INHK103	2	4
INHK841E INHK841L	Technology of Control	5	2		2	K	INHK821E INHK841L*	2	4
INHK312L	Hardware Programming 2	3			2	P	INHK311E	1	5
INHK531E	Decision Support Systems	2	2			K	INHK501E	2	6
INHS001X	Theses 1	5				P	INHK302E	F	6
INHS002X	Theses 2	10				P	INHK302E	F	7

Specialization - Infocommunication Networks

Code	Subject	Credit	Hrs per week			Exam	Prere- quisites	Period	Semester
			Th.	Practice					
				CR	CL				
INHC701E INHC701L	Telecommunication Systems	5	2		2	K	INHK841E INHC701L*	1	5
INHC711E	Performance Analysis of Infocommunication Networks	4	4			K	INHK521E	1	5
INHC301X	Practice 1	2				P	INHK301E	1	5
INHC721E INHC721L	Introduction to Programming of CISCO Equipements 1	5	2		2	K	INHK721E INHC721L*	1	5
INHC402E INHC402G	Information and Coding Theory	4	2	2		K	INHK121E INHC402G*	2	6
INHC411E INHC411L	Data Security	6	4		2	K	INHK451E INHC411L*	2	6
INHC302X	Practice 2	4				P	INHC301X	2	6
INHC722E INHC722L	Introduction to Programming of CISCO Equipements 2	4	2		2	K	INHK721E INHC722L*	2	6
INHC731E	High-Speed Networks	4	4			K	INHK721E	1	7
INHC601E INHC601L	Multimedia	6	4		2	K	INHK501E INHC601L*	1	7
INHC741E INHC741L	Specialization Oriented Applications	4	2		2	K	INHK721E INHC741L*	1	7
	Free choice 1	4							
	Free choice 2	2							

Specialization - Measurement and Process Management

Code	Subject	Credit	Hrs per week			Exam	Prere- quisites	Period	Semester
			Th.	Practice					
				CR	CL				
INHM101E INHM101L	Simulation methods in computer systems	5	1		4	P	INHK201E	1	5
INHM801X	Practice 1	2				P	INHK811E	1	5
INHM811E INHM811L	Computer aided measurement and process control	4	2		2	K	INHK841E INHM811L*	1	5
INHM841E INHM841L	Technologies of measurements	5	2		3	K	INHK821E INHM841L*	2	6
INHM821E INHM821L	Microcontroller Systems	3	1		2	P	INHK831E	2	6
INHM831E INHM831L	DSP, Digital Signal Processing and Signal Processors	5	1		4	P	INHM811E	2	6
INHM802X	Practice 2	4				P	INHM801X	2	6
INHM601E INHM601L	Technological Image Processing	5	2		3	K	INHK831E INHM601L*	1	7
INHM851E	Sensors and Controllers	3	2		1	K	INHK801E	1	7
INHM861E INHM861L	Specialization Oriented Applications	4	2		2	K	INHK841E INHM861L*	1	7

	Free choice 1	6							
	Free choice 2	4							
	Free choice 3	4							

Specialization - Corporate IT Systems

Code	Subject	Credit	Hrs per week			Exam	Prere- quisites	Period	Semester
			Th.	Practice					
				CR	CL				
INHE502E INHE502G	System Theory	3	2	2		K	INHE502G*	1	5
INHE531X	Practice 1	6				P	INHK301E	1	5
INHE902E INHE902G	Production Management	5	1		4	K	INHE502E INHE902G*	2	6
INHE522E INHE522G	Quality Management	5	1	4		K	INHE502E INHE522G*	2	6
INHE541E INHE541G	Management Information Systems 1	4	2	4		K	INHK511E INHE541G*	2	6
INHE551E INHE551G	Production Informatics 1	4	2	1		K	INHK912E INHE551G*	2	6
INHE532X	Practice 2	6				P	INHE531X	2	6
INHE542E INHE542G	Management Information Systems 2	3	2	2		P	INHE541E	1	7
INHE552E INHE552G	Production Informatics 2.	3	1	2		P	INHE551E	1	7
INHE561E INHE561G	Office Work Automation	4	2	4		P	INHE541E	1	7
INHE571G	Project Management	4	0	6		P	INHE502E	1	7
	Free choice 1	4							
	Free choice 2	3							

Economical and human knowledges

Code	Subject	Credit	Hrs per week			Exam	Prere- quisites	Period	Semester
			Th.	Practice					
				CR	CL				
INHK902E	Sociology	2	2			K		2	2
INHK912E	Economy for Engineers	4	3			K		1	3
INHK922E INHK922G	Economical Processes of Enterprises	4	1	2		K	INHK912E INHK922G*	2	4
INHK932E INHK932G	Basics of Management for Engineers	4	1	3		K	INHK932G*	2	6
INHK942E INHK942G	The Bases of Quality Management	4	1	1		K	INHK932E INHK942G*	1	7
INHK952G	Law and State Administration	2	0	1		P		1	7

Exam: K – kollokvium - P – practical

sign Prerequisites denoted with a star (*) have to be fulfilled in paralell with the course.

Subject programs

DISCRETE MATHEMATICS INHK103

Topics:

Sets, set algebra, relations, functions. Equivalence and ordering. Synthesis of number concept.

Natural numbers, operations, sorting, mathematical induction. Integers, rational numbers, real numbers, cardinality. Complex numbers, its canonic, trigonometric and exponential forms, nth root, roots of unity. Irrational, algebraic and transcendental numbers.

Fundamental theorem of algebra and its consequence. Polynoms, rational fractional functions, method of partial fractions.

Elements of combinatorics. Enumerative basic exercises: permutations, combinations and variations without and with repetition. Binomial theorem, polynomial theorem. Cardinality of finite sets' union, intersection and complements of intersections (sieve theory). Partition problems. Combinatorial probability. Total probability, Bayes's theorem. Discrete distributions. Expected value, standard deviation. Law of large numbers.

Compulsory/Recommended Readings:

Agnew, J. – Knapp, R.C.: Linear Algebra with Applications. Brooks/Cole Publ. Co., Monterey, California, 1978.

Birkhoff, G. – MacLane, S.: A Survey of Modern Algebra. 3rd Edition, MacMillan Company, 1965.

Davis, P.J.: The Mathematics of Matrices. Blaisdell Publ. Co., London, 1965.

Kaner, P.: Integrated Mathematics Scheme. IMSN1. Bell & Hyman, London,

1984. Lang, S.: Linear Algebra. 2nd Edition. Addison-Wesley Publ. Co., 1971.

Schreier, O. – Sperner, E.: Introduction to Modern Algebra and Matrix Theory. 2nd Edition, Chelsea, 1959.

Tucker, A.: Applied Combinatorics. (2nd Edition), John Wiley and Sons, New York, 1984.

CALCULUS 1 INHK111

Topics:

Sequences, properties and convergence. Cauchy's convergence criterion.

Real functions and their inverses, composite functions, elementary functions. Limit and continuity of functions. Properties of continuous functions. Differentiability of real functions, calculus rules. Mean value theorems. Taylor's formula. Graphing and discussing functions.

Extremal values. Local and global properties of functions.

Series, convergence, absolute convergence, convergence criteria.

Series of positive terms, reordering.

Compulsory/Recommended Readings:

Binmore, K.G.: Mathematical Analysis. A straightforward approach. Cambridge,

1989.

Kaner, P.: Integrated Mathematics Scheme. IMSN1. Bell & Hyman, London, 1984.

Lang, S.: Undergraduate Analysis. [Undergraduate Texts in Mathematics.]

Springer, New York – Berlin – Heidelberg – Tokyo, 1983. ISBN 0-387-90800-5.

LOGIC IN COMPUTER SCIENCE

INHK401

Topics:

The language of first-order-logic, terms, formulas. Free variables and bounded variables, bounded variables renaming, quantifier-free formula. Term substitution. Interpretations, truth assignments. Satisfiability, logically valid formulas and not-valid formulas. Logical equivalent. Conjunctive and disjunctive normal forms, prenex normal forms, Skolem normal form. Logical consequences. Predicate calculus, theory of deduction, rules of natural derivation. Proof theory. First order theories.

Compulsory/Recommended Readings:

Kleene S.C.: Mathematical Logic, Dover Publications, 2002

Robbin, J.W.: Mathematical Logic: A First Course Dover Publications, 2006

Mendelson, E.: Introduction to Mathematical Logic, Chapman & Hall; 2009

Quine, W.V.: Mathematical Logic, Revised Edition, Harvard University Press, 1981

INTRODUCTION TO INFORMATICS

INHK201

Topics:

Computer as information processing machine. Computer architectures. Basic terminology of

informatics (data, program, compiler, interpreter, programming, operating system, software, system software, application software, bit, byte, compatibility, syntax, semantics, programming languages, spreadsheet programs, text editors, database management systems). Types and use of peripheral devices. Concept of operating systems. Algorithms. Scales, conversion of conversion. Computer information representation (address, logical, string and numerical data, operations and programs). Basics of computer processors. Programming computers. Programming in Machine code. Assembly and high level programming languages. Basic algorithms (ordering, searching, picking). Network basics. Steps of information system development.

Compulsory/Recommended Readings:

J. G. Brookshear: Computer Science: An Overview, Seventh edition. Addison Wesley, 2003.

L. Snyder: Fluency with Information Technology: Skills, Concepts, and Capabilities. Addison Wesley, 2004.

Reed, D.: Balanced Introduction to Computer Science, Prentice Hall; 2007

PHYSICS 1.

INHK801

Topics:

Physical concepts and quantities, systems of units. Description of motion of point-like particle. The concepts of mass and momentum, the conservation of linear momentum. Newton's laws, force laws and their simple applications: throws, harmonic motions. The Galileo's principle of relativity, inertial forces. The law of angular momentum, conservation of angular momentum. Equilibrium of rigid bodies. The concepts of work and kinetic energy, the theorem of work. Potential energy, conservation law of mechanical energy. Elastic bodies, Hooke's law, elastic strength. Statics of liquids and gases. Stream of fluids, the equation of continuity, the Bernoulli's law and its application. Elastic waves; propagation, basic wave phenomena. The concept of temperature, temperature scales; equations of states. Interpretation of internal energy, the first law of the thermodynamics, specific heat. Reversible and irreversible processes. Heat engines and refrigerators. The second law of the thermodynamics. Experiences on molecular structure of matter; Dalton's laws, Avogadro's law, Brownian motion. Potential energy of molecular interaction, surface tension, capillarity. The kinetic model of gases. The concept of probability distribution, probability density functions. The Maxwell-Boltzmann distribution. Micro- and macrostates. The concept of statistical weight. Statistical interpretation of entropy; free energy and free enthalpy. Phase transitions, chemical potential. More component systems, gas mixtures, dilute solutions. Transport phenomena: diffusion, osmosis, heat conduction, viscosity.

Compulsory/Recommended Readings:

Halliday, Resnick, Krane: Physics, John Wiley & Sons Inc.

Sears, Zemansky, Young: University Physics, Addison-Wesley Publishing Company

Giancoli, D.C.: Physics: Principles with Applications, Prentice Hall, 2004

ELECTRONICS 1

INHK811

Topics:

Characteristics of passive electronic components; RC and RLC circuits; Semiconductors, pn junctions. Characteristics of discrete semiconductors: diodes, bipolar junction transistors, field effect transistors, opto-electronic devices; Operation of simple discrete circuits: amplifiers, oscillators, rectifiers, power supplies.

The students know the operation, the characteristics and the applications of basic electronic components.

The students are able to calculate numerical results for simple electronic circuits.

Compulsory/Recommended Readings:

P. Horowitz – W. Hill: The art of electronics, Cambridge University Press, 1989

D.I. Crecraft, David Gorham: Electronics, Nelson Thornes, 2003

Mimms III, F.M.: Getting Started in Electronics, Master Publishing, Inc. 2003

CALCULUS 2

INHK112

Topics:

Notion of Riemann integral, integration of elementary functions. Primitive functions, integration methods. Mean value theorems. Riemann-Stieltjes integral and its properties. Notion of measure (computation of arc length, area, volume, and surface). Improper integrals. Ordinary differential equations. Elementary solution methods of first-order differential equations. Higher-order differential equations of constant coefficients. Linear homogeneous and inhomogeneous second-order differential equations. Vector valued functions of several variables. Metrics and norm. Continuity of functions of several variables. Differentiability, partial differentiability, directional differentiability, gradient, composite functions. Mean value theorem, Taylor's theorem for functions of several variables. Extremal values. Implicit and inverse function theorems. Multiple Riemann integral, computation, and applications. Integral transformations and their applications. Sequences and series of functions. Power series. Operations with function series.

Compulsory/Recommended Readings:

- Binmore, K.G.: Mathematical Analysis. A straightforward approach. Cambridge, 1989.
- Kaner, P.: Integrated Mathematics Scheme. IMSN1. Bell & Hyman, London, 1984.
- Lang, S.: Undergraduate Analysis. [Undergraduate Texts in Mathematics.] Springer, New York – Berlin – Heidelberg – Tokyo, 1983. ISBN 0-387-90800-5.
- Rudin, W.: Principles of Mathematical Analysis. 3rd Edition, 1976. McGraw-Hill International Editions. Printed in Singapore. ISBN 0-07-054235-X.

DATA STRUCTURES AND ALGORITHMS

INHK421

Topics:

Concept and classification of data structures. Operations on data structures (create, add, delete, change, search, traverse, process). Representation and implementation and usage of data structures. Abstract data structures. Set, multi-set, array, associative array, list, stack, queue, string, tree, balanced tree, red-black tree, B-tree, net, record. File operations (create, modify, process, reorganize, sort.) File structures (simple and complex), linking, indexing. Serial, sequential, direct, random, indexed, inverted, multi-list, B+-tree files. Multi-dimensional index.

Compulsory/Recommended Readings:

- G. Gonnet, R. Baeza-Yates: Handbook of algorithms and data structures. In Pascal and C., Addison-Wesley. 1991.
- R. Sedgewick: Algorithms in C++, Addison-Wesley. 1991.
- E. Horowitz, S. Shani: Fundamentals of Computer Algorithms, Computer Science Press, 1998.

PROGRAMMING LANGUAGES 1

INHK301

Topics:

History of programming languages. Classification of programming languages: imperative

(procedural and object oriented), declarative (functional and logic), special and alternative languages. Specifying syntax. Character set. Lexical elements (symbolic names, comment, label, literals). Named constant, variable. Data types (predefined and programmer defined, scalar and structured). Declaration. Expressions. Statements. Assignment, jump, selection, iteration. Program units (subprogram, block, package, task). Parameter evaluation, parameter passing. Scope and life time. Compilation unit. Input-output, files. Abstract data type. Exception handling. Generic programming. Parallel programming.

Compulsory/Recommended Readings:

- R.W. Sebesta, Concepts of Programming Languages. Addison-Wesley, 2006.
- M. L. Scott, Programming Language Pragmatics. Morgan Kaufmann, 2009.
- Louden, K.C.: Programming Languages: Principles and Practice, Course Technology, 2002
- Webber, A.B.: Modern Programming Languages: A Practical Introduction, Franklin Beedle & Associates 2002

OPERATING SYSTEMS

INHK211

Topics:

The hierarchical structure of computer systems, the notion and role of operating system. Basic

hardware notions concerning operating systems: processors, main memories, storages, other peripherals, interrupt system. The evolution of operating systems. Operation systems components and services: system management (CPU scheduling, interrupt handling, process synchronization, process control, memory management, storage management, data (file) management, network access management, protection subsystem, logging and accounting, operator interface);

program development support (syntax oriented text editors, compilers, interpreters, linkage editors, loaders, library handlers, debuggers, IDE-s, runtime systems); application support (command line subsystem, GUI, system services, application packages);

Labor topics: the above problems focused on a practically known and accepted OS (Win XP, Unix/Linux/Solaris).

Compulsory/Recommended Readings:

- Silberschatz, Abraham, Operating system concepts, Addison-Wesley, c1994, xvi, 780 p. : ill. ; 25 cm, ISBN 0 201 59292 4
- Nutt, Gary J., Operating systems : a modern perspective, Addison- Wesley, 1997. - XXII, 630 S. , ISBN 0-8053-1295-1
- William Stallings: Operating systems (Internals and design principles), Prentice Hall (4. ed.) 2001.

PHYSICS 2

INHK802

Topics:

Basic concepts and phenomena of electrostatics. Electric charge, force between charges.

Coulomb's law. Electric charge and matter. The concept of electric field. Gauss's law. Electrostatic potential. The electric dipole moment, the electric field of a system of charges, the principle of superposition. Conductors and insulators. Capacitance and capacitors. Energy density of the electrostatic field. Electric current and electric resistance, current density. Resistivity and conductivity. Ohm's law. Electronic circuits, the electromotive force. Kirchhoff's rules, an RC circuit. The mechanism of the electronic conduction of solids, liquids and gases; Faradays law of electrolysis, galvanic cells, batteries. The concept of the magnetic field and the definition of magnetic field induction vector. Magnetic force acting on a current or a moving charge. The magnetic field induced by a current or a moving charge Biot–Savart's and Amper's law. Magnetic properties of matter. Dia-, para- és ferromagnetic materials. Motion of charged particles in electric and magnetic field, mass spectrometers and particle accelerators. Faradays law of induction. The properties of the induced electric field, self induction, RL circuits. Energy stored in the magnetic field. Electromagnetic oscillations. Free and damped oscillations in LC and RLC circuits, forced oscillations, coupled oscillations, resonance. Alternating current circuits. Motors and generators, the transformer. The concept of displacement current and induced magnetic field. The Ampere-Maxwell law, Maxwell's equations. Electromagnetic waves. The properties and propagation of light, emission and absorption of light. Optical devices. The light as an electromagnetic wave. The diffraction of light on a slit, on double slits and on optical gratings. The propagation of light in materials, absorption and scattering. The light and the quantum mechanics; the properties of thermal radiation, Planck's law, the photoelectric effect, the concept of the photon. The Compton effect and the spectral lines of atoms. The wave properties of material particles, material waves. The Heisenberg uncertainty principle. The Schrödinger equation, the quantum states of simple systems. The structure of the atom. The Thompson model. The Rutherford experiment. The Bohr/Rutherford model of the atom. The simple quantum mechanical model of the Hydrogen atom. The quantum numbers. The spin of the electron. The characteristic X radiation. The Pauli principle and the structure of many electron atoms. Spontaneous and induced emission light, and the laser effect. Chemical bonds. The electronic properties of solids, band structure and quantum statistics. Contact and thermoelectric phenomena. Electric current in semiconductors. Superconductivity. The discovery of the atomic nucleus. Radioactivity. The effect and measurement of radioactive radiation. Cosmic rays. The properties and structure of the atomic nuclei. Nuclear models. Nuclear fission and fusion. Energy from the nuclei, nuclear reactors. Elementary particles and fundamental interactions. The basic principles of cosmology.

Compulsory/Recommended Readings:

Halliday, Resnick, Krane: Physics, John Wiley & Sons Inc.

Sears, Zemansky, Young: University Physics, Addison-Wesley Publishing

Company Giancoli, D.C.: Physics: Principles with Applications, Prentice Hall, 2004

ELECTRONICS 2
INHK812

Topics:

Analog signals, frequent tasks of analog electronics, amplification, coupling, power supply, function generation, filtering, voltage regulation. Integrated operational amplifiers: internal circuit, external feedback, basic op-amp circuits. Electronic measuring devices, signal generators, oscilloscopes. Analog/Digital and Digital/Analog conversion. The students know the operation and the applications of basic analog electronic circuits. The students know the usage of basic electronic measuring devices.

Compulsory/Recommended Readings:

- P. Horowitz – W. Hill: The art of electronics, Cambridge University Press, 1989
- D.I. Crecraft, David Gorham: Electronics, Nelson Thornes, 2003
- Mimms III, F.M.: Getting Started in Electronics, Master Publishing, Inc. 2003

DIGITAL TECHNOLOGIES

INH831

Topics:

Basic logic concepts. Logic states, logic identities. Gates and truth tables. Discrete circuits for gates. IC gate circuits (TTL, CMOS, NMOS). Interfacing between logic families. Driving external loads. Digital interconnections, driving cables, eliminating noise problems and hazards. Combinational logic circuits; minimization and Karnaugh maps. Encoders, decoders, binary adders, PAL and PLA circuits. Sequential logic circuits: memories, counters, shift registers, serial-parallel converters, sequential PALs. Optoelectric devices, display circuits. A/D and D/A converters.

The students are able to understand the most important theoretical and practical aspects of digital electronics. They are able to analyse and design simple digital networks.

Compulsory/Recommended Readings:

- I.H. Gould, F.S. Ellis: Digital computer technology; an introduction to logic design and practice, New York, 1963
- Chris Woodford: Digital Technology (Science in Focus), Chelsea House Publications, 2006
- Horowitz-Hill : The Art of Electronics, Cambridge University Press, 1989

PROGRAMMING LANGUAGES 2

INH302

Topics:

The object oriented paradigm: class, object, encapsulation, visibility, inheritance, polymorphism, early and late binding, messages. The basic elements of UML: Class Object and Sequence Diagrams. Pure and hybrid object oriented programming languages. Algorithmical object oriented programming languages (Java, C++). Data driven programming languages, dataflow languages. Concurrent programming: multithread programs, asynchronous communication, deadlocks, mutual exclusions, conditional synchronization, scheduling.

Labor practices deal with the Java programming language.

Compulsory/Recommended Readings:

- R.W. Sebesta, Concepts of Programming Languages. Addison-Wesley, 2006.

- M. L. Scott, Programming Language Pragmatics. Morgan Kaufmann, 2000.
- Miles, R., Hamilton, K.: Learning UML 2.0, O'Reilly Media, 2006
- Fowler, M.: UML Distilled: A Brief Guide to the Standard Object Modeling Language, Addison-Wesley Professional, 2003
- Liang, Y.D.: Introduction to Java Programming, Comprehensive Version, Prentice Hall, 2008
- Stroustrup, B.: The C++ Programming Language: Special Edition, Addison-Wesley Professional, 2000

DATABASE SYSTEMS

INHK501

Topics:

Problems of traditional data manipulation, characteristics of database approach, the three-schema architecture (internal level, conceptual level, external level), data independence, types of DBMS users, database administrator, DBMS languages, (DDL, DML, host language, data sublanguage), CODASYL (DBTG) reports, basic concepts of the network model.

Entity-Relationship model concepts: entities, attributes, relationships, types, instances, structural constraints, weak entity types, partial key, notation for Entity-Relationship (ER) diagrams.

The relational data model: relation schema, relation, relational model constraints (superkey, key, foreign keys), practical questions, update operations, the relational algebra, relational calculus, functional dependencies, normal forms, normalization process, algorithms.

SQL - a relational database language, embedded systems, object oriented concepts, elements of ODL.

Study of a concrete DBMS.

Compulsory/Recommended Readings:

- R. Elmasri – S. B. Navathe: Fundamentals of Database Systems, Addison Wesley, 2004.
- J.F.Ullman – J. Widom: A First Course in Database Systems, Prentice Hall, 1997
- Rob, P., Coroner, C.: Database Systems: Design, Implementation, and Management, Course Technology, 2007
- Hoffer, J.A., Prescott, M., Topi, H.: Modern Database Management, Prentice Hall, 2008

PROBABILITY THEORY AND MATHEMATICAL STATISTICS

INHK121

Topics:

The statistical background of probability theory. Events. Probability space. Combinatorial probability. Conditional probability, independence. Theorem of total probability, the Bayes theorem. Discrete random variables, expectation, variance. Binomial, hypergeometric, and the Poisson distributions. Distribution function, density function, the general concepts of the expectation and variance. Uniform, exponential and normal distributions. Joint distribution function, independence. Correlation coefficient. Law of large numbers, central limit theorem. Statistical sample, sampling methods. Empirical distribution function.

Empirical mean, empirical variance. Estimators and confidence intervals. Testing hypotheses. Parametric tests: u-, t-, F-, and chi-square tests. Nonparametric tests: chi-square, sign, Wilcoxon, and Mann-Whitney tests. Testing normality. Linear regression. Analysis of variance. At practice the presentation of a statistical package.

Compulsory/Recommended Readings:

- Ash, R.: Basic probability theory. Wiley, New York, 1970.
- Feller, W.: Introduction to probability theory and its applications. Wiley, New York, Vol. I, 1957.
- Williams, D. Weighing the odds. A course in probability and statistics. Cambridge University Press, Cambridge, 2001.
- Graham, R.L. – Knuth, D. E. – Patashnik, O.: Concrete mathematics. Addison-Wesley, 1994.
- Stoodley, K.D.C. – Lewis, T. – Stainton, C.L.S.: Applied statistical techniques. Ellis Horwood, Chichester, 1980.

SIGNALS AND SYSTEMS

INH821

Topics:

This course covers fundamentals of signal and system analysis, with applications drawn from filtering, audio and image processing, communications, and automatic control. Topics include convolution, Fourier series and transforms, sampling and discrete-time processing of continuous-time signals, modulation, distortionless transmission, Laplace and Z-transforms, and feedback systems.

The students know the element of fundamentals of signal and system analysis. The students are able to implement various transforms, sampling and handling continuous discrete systems.

Compulsory/Recommended Readings:

- David Crecraft, Stephen Gergely: Analog Electronics: Circuits, Systems and Signal Processing, Butterworths, 2003
- Oppenheim, A.V., Willsky, A.S., Hamid, S.: Signals and Systems, Prentice Hall, 1996
- McMahon, D.: Signals & Systems Demystified, McGraw-Hill Professional, 2006

COMPUTER NETWORK ARCHITECTURES AND PROTOCOLS

INH721

Topics:

Network topologies and architectures. Transmission media, analog and digital transmission signaling and coding. Switching methods. The ISO OSI reference model, describing the layers. Channel access methods and implementations: ALOHA protocols, CSMA, collision-free, limited-contention free. The IEEE 802.3 standard and the ETHERNET. Token bus, token ring. Flow control of datalink layer (frames and sliding window protocols). The routing algorithms of the network layer (shortest path, centralized -

distributed, hierarchical). Network layer protocols. Network security, encryption. Application layer, electronic mail, catalogue systems.

Compulsory/Recommended Readings:

Andrew S. Tanenbaum: Computer Networks, 4th Edition, Prentice-Hall, 2003.

William Stallings: Data and Computer Communications, 7th Edition. Prentice-Hall, 2003.

Regis J. (Bud) Bates, Donald W. Gregory: Voice and Data Communications Handbook, 4th Edition, McGraw-Hill, 2001.

RFC Documents: <http://www.rfc-editor.org/>

PRACTICE IN ELECTRONICS

INHK813

Topics:

Analog electronics lab exercises: Specification of operational amplifiers, basic op-amp circuits: inverting, non-inverting, summing and differential amplifiers, voltage-current converters, integrator, differentiator, oscillator circuit

Digital electronics lab exercises: Logic gates; basic combinational logic circuits: encoders, decoders, binary adders; basic sequential logic circuits: memories, counters, shift registers, serial-parallel converter.

Students acquire practical skills that are necessary to work in an electronic laboratory. They are able to build and analyze basic analogue and digital circuits.

Compulsory/Recommended Readings:

P. Horowitz – W. Hill: The art of electronics, Cambridge University Press, 1989

D.I. Crecraft, David Gorham: Electronics, Nelson Thornes, 2003

Mimms III, F.M.: Getting Started in Electronics, Master Publishing, Inc. 2003

HARDWARE PROGRAMMING 1

INHK311

Topics:

The goal of the course is to provide the students with current hardware knowledge needed to

prepare effective codes, to follow the new items appearing on the market, and to be able to program concrete hardware devices. Main focuses:

Parallel programming – Concurrent and distributed programming, synchronizing processes, using computer resources.

Embedded systems – Particularities of embedded systems, their programming toolchain. Communicating with embedded systems. Microcontrollers, assembly programming. Using MPLAB and PICKit3.

Real-time systems – hard and soft real time systems and their programming. Kernel mode programming, processes and semaphores. Interrupts and exceptions. FPGA for high performance computing – The structure and usage of FPGA. Prototyping electronic circuits using the Verilog HDL (combinational and sequential circuits, state machines). Synthesizing PicoBlaze microcontroller in FPGA. Programming model for FGPA as hardware accelerator

for computers. Increasing computational power using FPGAs: migrating existing applications to FPGA.

Compulsory/Recommended Readings:

- J. DONGARA et al : SOURCEBOOK OF PARALLEL COMPUTING Elsevier Science, 2003; ISBN: 1-55860-871-0
- Richard H. Carver and Kuo-Chung Tai: Modern multithreading: implementing, testing, and debugging multithreaded Java and C++/Pthreads/Win32 programs Wiley & Sons, ISBN: 0-471-72504-8
- Cameron Hughes, Tracey Hughes: Parallel and Distributed Programming Using C++ Addison Wesley (2003), ISBN : 0-13-101376-9
- M. Barr: Programming Embedded Systems in C and C++ O'Reilly 1999, ISBN : 1-56592-354-5
- J. A. Fisher, et al: Embedded Computing Elsevier 2005, ISBN: 1-55860-766-8
- ALBERT M. K. CHENG: REAL-TIME SYSTEMS Wiley & Sons 2002, ISBN 0-471-18406-3
- Qing Li and Carolyn Yao : Real-Time Concepts for Embedded Systems CMP Books, 2003, ISBN 1-57820-124-1
- Sid Katzen, The Quintessential PIC Microcontroller, Springer-Verlag
- Pong P. Chu: FPGA prototyping by Verilog examples. Wiley & Sons, 2008. ISBN 978-0-470-18532-2
- D. Pellerin, S. Thibault : Practical FPGA Programming in C Prentice Hall, 2005. ISBN 0-13-154318-0

INTRODUCTION TO LABVIEW PROGRAMMING

INHK321-K3

Topics:

Introduction to the application environment: frontend and backend panels, toolbar, palettes, help system. Basic concepts: control and indicator, vi and sub-vi. Programming structures: series of events, cycles, conditional structures, formula node. Data structures: data types, arrays, strings, clusters and their operations. Basic tasks: Generating signals, analysis and display: usage of signal processing packages and various types of graphs, file operations, control of instruments, management of equipments. Basic program structures: state machine, event-driven programming, producer-consumer. Network communication: remote panel access, using UDP, TCP/IP protocols. Additional packages: image and signal processing.

Compulsory/Recommended Readings:

- <http://www.ni.com/academic/Johnson>, G., Jennings, R.: LabVIEW Graphical Programming, McGraw-Hill Professional, 2006
- Wells, L.K.: LabVIEW for Everyone: Graphical Programming Made Even Easier, Prentice Hall; Bk&CD-Rom edition 1996

INTRODUCTION TO ARTIFICIAL INTELLIGENCE

INHK441

Topics:

Artificial intelligence methods and techniques. Problem representations, state-space representation, examples. State-space graph, graph-search procedures: depth-first, breadth- first. Backtracking, optimal search strategies, heuristics. A and A* algorithms, completeness, monotone restriction. Problem-reduction representation and AND/OR graphs. Search procedures for AND/OR graphs, algorithm AO. Two-person, perfect-information games, game trees, winning strategy. Mini-max procedure, alpha-beta pruning procedure.

Compulsory/Recommended Readings:

- N. Nilsson, Artificial Intelligence, A New Synthesis, The Morgan Kaufmann Series in Artificial Intelligence, 1998.
- S. J. Russel, P. Norvig, Artificial Intelligence, A Modern Approach, Prentice- Hall, 1995.
- Finlay, J., Dix, A.: An Introduction To Artificial Intelligence, CRC Press, 1996

ENTERPRISE INFORMATION SYSTEMS

INH511

Topics:

General methodic introduction. Use of the means of information technology (IT) (client / server architecture, Internet / intranet / extranet, workflow technique, database technology, database management). Demands made on the complex control systems (CCS). Analysis of the company information system (CIS)), structure and characteristics of the system and a and the enforcement of the integrated view. Presentation and main characteristics of an industrial company management system. Conception and architecture of the system. Process of the dynamic enterprise modelling.

Data modelling, normalization, Entity - Relationship models. Definition of database and characteristics of relation databases. Description of the components (functions) a company information system by means of the so-called description levels. Application development methodologies. System planning methodologies and techniques (SSADM, ARIS, etc..). Selection, introduction, putting into operation of company information systems and their support by users.

The definition of being integrated concerning the company and the information system problem of the real duration (demonstration system: SAP). Entry the system, menu structure of the system, navigation in the system. Most important modules. Monitoring of processes in the system. Normalization jobs, E-R modelling practice.

Compulsory/Recommended Readings:

- Marianne Bradford: Modern ERP: Select, Implement & Use Today's Advanced Business Systems ISBN-10: 0557012910 lulu.com
- Norbert Welti: Successful SAP RA3 implementation: Practical Management of ERP R. Kelly, Jr. Rainer, Efraim Turban, Richard E. Potter: Introduction to Information Systems: Supporting and Transforming Business by (- Jan 17, 2006)
- Stair, R., Reynolds, G.: Principles of Information Systems, Course Technology, 2007

MODELING AND ANALYSIS OF INFORMATION TECHNOLOGY SYSTEMS

INH521

Topics:

Distribution derived from exponential distribution. Renewal Theory. Poisson Process. Markov Chains, Birth-Death Processes. Basic Queueing Models. Markov-type queueing networks, finite and infinite -source queueing systems and their applications. Modeling tools

Compulsory/Recommended Readings:

Haverkort B.: Performance of computer communication systems: a model-based approach, J. Wiley, 1998.
Daigle J.N.: Queueing Theory for Telecommunications, Addison-Wesley, 1992
Gross D., Harris C.: Fundamentals of Queueing Theory, John Wiley, New York, 1985
Hayes J.F. , Babu T.V.J.: Modeling and Analysis of Telecommunication Networks, Wiley-Interscience.

FOUNDATION OF COMPUTER SECURITY

INHK451

Topics:

Physical, administrative and algorithmic aspects of security, regulations (laws, international norms, local and institutional rules). Network security (password, firewall, package signature). Security classes, the bases of Common Criteria, security audit, preparation of institutional security concept (risk analysis, risk management). Institutional security regulation (). Viruses, Trojan horses and protection against that. Foundation of cryptography: encoding, decoding, symmetric, asymmetric and hybrid cryptosystems. One way and one way trapdoor functions. Cryptographic primitives: DES, RSA, DSA. Digital signature. Public key infrastructure.

Compulsory/Recommended Readings:

Pieprzyk, Josef, Hardjono, Thomas, Seberry, Jennifer , Fundamentals of Computer Security, 2003, ISBN: 3-540-43101-2
Gollman, D.: Computer Security, Wiley, 2006
Stallings, W., Brown, L.: Computer Security: Principles and Practice, Prentice Hall, 2007

TECHNOLOGY OF CONTROL

INHK841

Topics:

The concepts of the control. Structures of control, building up an automatic control, targets of the technology of control, strategies of control. Open and close systems. Linear systems. Signal transmission in control systems. Signal transmission. Requirements of control. Linear systems with analog signals. Stability. Static behaviour of the control loop. Systems with open loop and feedback. Non-linear control systems. Characteristics of the quality. The PI and the PD signals, analog and digital PID controls.

Compulsory/Recommended Readings:

Christopher Kilian: Modern Control Technology, Delmar, 2007
Robert N. Bateson: Introduction to Control System Technology, Prentice Hall, 2001

Landau, I.G., Zito, G.: Digital Control Systems: Design, Identification and Implementation (Communications and Control Engineering), Springer, 2006

HARDWARE PROGRAMMING 2

INHK312

Topics:

The goal of the course is to provide the students with current hardware knowledge needed to prepare effective codes, to follow the new items appearing on the market, and to be able to program concrete hardware devices. Main focuses:

Parallel programming – Concurrent and distributed programming, synchronizing processes, using computer resources.

Embedded systems – Particularities of embedded systems, their programming toolchain. Communicating with embedded systems. Microcontrollers, assembly programming. Using MPLAB and PICKit3.

Real-time systems – hard and soft real time systems and their programming. Kernel mode programming, processes and semaphores. Interrupts and exceptions. FPGA for high performance computing – The structure and usage of FPGA. Prototyping electronic circuits using the Verilog HDL (combinational and sequential circuits, state machines). Synthesizing PicoBlaze microcontroller in FPGA. Programming model for FGPA as hardware accelerator for computers. Increasing computational power using FPGAs: migrating existing applications to FPGA.

Compulsory/Recommended Readings:

J. DONGARA et al : SOURCEBOOK OF PARALLEL COMPUTING Elsevier Science, 2003; ISBN: 1-55860-871-0

Richard H. Carver and Kuo-Chung Tai: Modern multithreading: implementing, testing, and debugging multithreaded Java and C++/Pthreads/Win32 programs Wiley & Sons, ISBN: 0-471-72504-8

Cameron Hughes, Tracey Hughes: Parallel and Distributed Programming Using C++ Addison Wesley (2003), ISBN : 0-13-101376-9

M. Barr: Programming Embedded Systems in C and C++ O'Reilly 1999, ISBN : 1-56592-354-5

J. A. Fisher, et al: Embedded Computing Elsevier 2005, ISBN: 1-55860-766-8

ALBERT M. K. CHENG: REAL-TIME SYSTEMS Wiley & Sons 2002, ISBN 0-471-18406-3

Qing Li and Carolyn Yao : Real-Time Concepts for Embedded Systems CMP Books, 2003, ISBN 1-57820-124-1

Sid Katzen, The Quintessential PIC Microcontroller, Springer-Verlag

Pong P. Chu: FPGA prototyping by Verilog examples. Wiley & Sons, 2008. ISBN 978-0-470-18532-2

D. Pellerin, S. Thibault : Practical FPGA Programming in C Prentica Hall, 2005. ISBN 0-13-154318-0

DECISION SUPPORT SYSTEMS

INHK531

Topics:

Normative rules of decision-making. General principle of decisions. Analysis of decisions and decision-making. Programmable and non-programmable decisions. Decisions made in doubtful and risky circumstances. Further grouping aspects. Quantitative appearance of doubtfulness and risk. Decision-making in a doubtful situation. Decision-making in a risky situation. Decision matrix. Decisions' tree. Definition and determination of usefulness. Collective decision-making. Strategies for collective decision-making. Collective decision-making methods. Application of Fuzzy logic in decision-making.

Compulsory/Recommended Readings:

Burnstein, F., Holsapple, C.W.: Handbook on Decision Support Systems 1: Basic Themes, Springer, 2008

John S. Hammond, Ralph L. Keeney, and Howard Raiffa: Smart Choices: A Practical Guide to Making Better Decisions ISBN-13: 978-1578515578

Harvard Business Review on Decision Making Harvard Business School Press ISBN-10: 1578515572

Specialization - Infocommunication Networks

TELECOMMUNICATION SYSTEMS

INHC701

Topics:

Physical transmissions: wired, wireless, transmission on ground and via satellites. Bases of optical transmission. Classifications of telecommunication systems. Requirements of signal transmission. Main network functions and their implementations. Typical network topologies any systems. Softwares in telecommunication. Basics of mobile telecommunication. GPS system.

Compulsory/Recommended Readings:

Annabel Z. Dodd: Essential Guide to Telecommunications, Prentice Hall, 2005

Martha Rosengrant: Introduction to Telecommunications, Prentice Hall, 2006

Hussain, K.M.: Telecommunications and Networks (Computer weekly) Focal Press, 1997

Saadawi, T.N., Ammar, M.H.: Fundamentals of Telecommunication Networks, Wiley- Interscience, 1994

PERFORMANCE ANALYSIS OF INFOCOMMUNICATION NETWORKS

INHC711

Topics:

Basic terminology of queueing systems and queueing networks. Methodology for system measures: analytical, approximation, simulation. Open, closed, mixed . queueing networks. Description of queueing networks: number of nodes, description, number of servers, service discipline, arrival and service intensity; network architecture, transitions. System measures: server utilisation, mean response time, mean waiting time, etc.

Obtaining performance measures with various software tools (PEPSY-QNS and WinPEPSY).
Case studies.

Compulsory/Recommended Readings:

Khalid Begain, Gunter Bolch, Helmut Herold: Practical Performance Modelling, Kluwer Academic Publisher, 2001

Gunter Bolch, Stefan Greiner, Kishor Trivedi: Queueing Networks and Markov Chains, J. Wiley, 1998, 2002

Boudewijn R. Haverkort: Performance of computer communication systems: a model-based approach, J. Wiley, 1998.

Raj Jain: The Art of Computer Systems Performance Modelling, J. Wiley, 1991

**INTRODUCTION TO PROGRAMMING OF CISCO EQUIPEMENTS 1
INHC721**

Topics:

The course gives an introduction to the router and switch programming.

Main topics of the course:

Router and switch system architectures, basic configuration tasks and tools. Password recovery, IP configuration, static and dynamic routing (RIP). Twisted Pair based communication standards, RJ-45 connector description and tests.

Traffic policy implementation, standard and extended access control lists. Network design.

Compulsory/Recommended Readings:

CCNA Academy materials: <http://cisco.netacad.net/>

Wendell Odom: CCNA Official Exam Certification Library (ICND 1 and ICND2), Cisco Press 2007, ISBN-10: 1587201836

Tod Lammle: CCNA: Cisco Certified Network Associate Study Guide: Exam 640-802, Sybex 2007, ISBN-10: 0470110082

**INFORMATION AND CODING THEORY
INHC401**

Topics:

General model of communication. Problem of coding: uniquely decodable and irreducible codes, Kraft-fano inequality, McMillan's theorem, optimal codes, method of coding. Block coding. Notion of information measure, Shannon entropy. Discrete memoryless channel, channel capacity. The main theorems of information theory. Data compression. Continuous channels.

Compulsory/Recommended Readings:

Ash, R.B.: Information Theory. New York, Dover Publications, 1965.

Csiszár I., Körner J.: Information Theory: Coding Theorems for Discrete Memoryless Systems. Budapest, New York, Akadémiai Kiadó, 1981.

Hankerson, D.R.: Introduction to Information Theory and Data Compression. CRC Press, 1998.

**DATA SECURITY
INHC411**

Topics:

Mathematical backgrounds (elementary number theory, algebraic structures, complexity theory). Pseudo random number generators. Classical cryptographic methods: Caesar, affine, substitutional, Vigenère encoding. Cryptoanalysis of the substitutional hiding method. Symmetric block coding methods: DES, AES. Public key methods: RSA, ElGamal, Hash functions used in cryptography. Block coding modes: ECB, CBC and CFB. Message authentication code. Digital signature, the DSA protocol. Key exchange. Public key infrastructures. Authentication, Secure network protocols: SSL, PGP. Security of mobile networks. Electronic payment systems.

Compulsory/Recommended Readings:

Pieprzyk, Josef, Hardjono, Thomas, Seberry, Jennifer, Fundamentals of Computer Security, 2003, ISBN: 3-540-43101-2

Lehtinen, R., Gangemi SR, G.T.: Computer Security Basics, O'Reilly Media, 2006

Dorothy Elizabeth Robling Denning: Cryptography and Data Security, Addison-Wesley Pub (Sd) 1982

**INTRODUCTION TO PROGRAMMING OF CISCO EQUIPEMENTS 2
INHC722**

Topics:

The course discusses advanced networking configuration problems.

The most important topics:

WAN data link configuration (PPP, Frame-Relay). Authentication, Accounting,

Authorization. Advanced routing problems (static routing in CIDR; EIGRP, OSPF configuration and tuning). Advanced DHCP (Relay agent, multiscope DHCP). Address realms – NAT, PAT.

Switch configuration, port status and role descriptions. VLAN, Inter-VLAN routing, VTP.

Compulsory/Recommended Readings:

CCNA Academy materials: <http://cisco.netacad.net/>

Wendell Odom: CCNA Official Exam Certification Library (ICND 1 and ICND2), Cisco Press 2007, ISBN-10: 1587201836

Tod Lammle: CCNA: Cisco Certified Network Associate Study Guide: Exam 640-802, Sybex 2007, ISBN-10: 0470110082

**HIGH SPEED NETWORKS
INHC731**

Topics:

Networking generations and the different technologies of the generations. Examples and study

of current high speed networking technologies. Multipurpose networks (Data, voice, video, fax, etc.) and the integration solution methods.

Compulsory/Recommended Readings:

Andrew S. Tanenbaum: Computer networks (4th ed.), Prentice Hall; 2003.
Stephen A. Thomas: •Stephen A. Thomas: IP Switching and Routing Essentials, Wiley, 2001.
Regis J. (Bud) Bates, Donald W. Gregory: Voice and Data Communications Handbook, 4th Edition, McGraw-Hill, 2001.

MULTIMEDIA

INHC601

Topics:

The computer based multimedia, multimedia hardware, networks, applications. Multimedia data and modeling, information retrieval, memory management. Multimedia environments and presentations. Frame systems, authoring and engineering.

Compulsory/Recommended Readings:

R.S. Tannenbaum: Theoretical foundations of multimedia, Comp. Sci. Press, 1998. S.J. Gibbs, D.C. Tsichritzis: Multimedia programming (Objects, environments and frameworks), Addison-Wesley, 1995.
W.I.Gorsky & al. (ed): The Handbook of multimedia information management, Prentice Hall, 1997.

PRACTICE 1

INHC301

The goals of the subject:

Improving the knowledge gained by fulfilling the main subjects of a specific direction and gathering practical experiences in a personal field of interest of the student by solving real life problems.

After these semesters the students will be in possession of knowledges of their research fields beyond the average student level. In case of enough advances the subject can serve as the theme of diploma work or PhD work.

Description:

- The students should choose the subject of this three-semester course after careful considerations. The departments could help in decisions of the students by providing summaries of previous works or giving informative presentations on the themes to be chosen.
- The details of the subject and the way of its development is determined by the tutor at the first seminar. The phases of the work can be the following: Search for literatures, system analysis, system design, construction, testing, implementation, documentation.
- The written report of the work of the actual semester (or the presentation of the application) should be handed over by the end of the semester. The scope of the report is about 10 pages.

- Elaborating the subject can be performed in small groups (2-3 persons) as well. In this case the individual work should be evaluated, too. The place of the work could be an external workplace, as well.

Compulsory/Recommended Readings:

- According to the guidance of the tutor
- According to the research for literature

PRACTICE 2
INHC302

The goals of the subject:

Improving the knowledge gained by fulfilling the main subjects of a specific direction and gathering practical experiences in a personal field of interest of the student by solving real life problems.

After these semesters the students will be in possessions of knowledges of their research fields beyond the average student level. In case of enough advances the subject can serve as the theme of diploma work or PhD work.

Description:

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Compulsory/Recommended Readings:

- According to the guidance of the tutor
- According to the research for literature

SPECIALIZATION ORIENTED APPLICATIONS
INHC741

The goals of the subject:

Improving the knowledge gained by fulfilling the main subjects of a specific direction and gathering practical experiences in a personal field of interest of the student by solving real life problems.

Compulsory/Recommended Readings:

According to the guidance of the tutor

Specialization - Measurement and Process Management

SIMULATION METHODS IN COMPUTER SYSTEMS

INHM101

Topics:

Relation of theory, experiment, and simulation. Model construction for natural phenomena.

Exact numerical solution of models.

Monte Carlo simulation: random number generators, random numbers of arbitrary distributions. Computer simulation of diffusion and growth processes, diffusion limited aggregation. Spreading phenomena: percolating liquids in porous materials, modelling epidemic spreading. Monte Carlo integration.

Technological application: Monte Carlo simulation of the fracture of reinforced composites.

Molecular dynamics simulations: numerical solution of ordinary differential equations.

Equation of motion of many particle systems. Program optimization, Verlet table, linked cell algorithms.

Technological application: computer modelling of the fracture of concrete and ferro-concrete. Cellular automata: discrete dynamical systems, coding system of automata.

From game of life to lattice gas models of fluids.

Technological application: modelling fluid flow in a pipe with an obstacle.

Compulsory/Recommended Readings:

V. Gould and J. Tobochnik, An introduction to Computer Simulation Methods (Addison-Wesley, 1999).

M. P. Allen and D. J. Tildesley, Computer Simulation of Liquids (Oxford University Press, 1996).

D. Rapaport, The Art of Molecular Dynamics Simulation, (Cambridge University Press, 2001).

K. Ohno, K. Esfarjani, and Z. Kawazoe, Computational Materials Science, (Springer, 1999).

COMPUTER AIDED MEASUREMENT AND PROCESS CONTROL

INHM811

Topics:

Structure of measuring systems, basic elements of the measuring system. Data transfer modes between the computers and measuring equipment, programming languages, programming tools. Basics of the process control, type of the control systems.. Fuzzy logic, neural networks and their application in the process control.

Compulsory/Recommended Readings:

Doebelin O.E.: Measurement Systems. Application and Design. McGraw-Hill, NewYork , 2004.

Kahler J., Frank H. Fuzzy-Logik und Fuzzy-Control, VIEWEG, 1994

Anderson N.A.: Instrumentation for Process Measurement and Control, Third Editon CRC Press; 1997

TECHNOLOGIES OF MEASUREMENTS

INHM841

Topics:

Basics. Measurement systems. SI system. Handling the measurement data. Scale transformation. Measurement errors, error propagation. Measurement of current, potetntial. Digital multimeter. Masurement of power and energy. Signal sources. Calibration. Analog and digital oscilloscopes. A/D, D/A converters.

Handling the instruments of measurement. Analysis of signals. Study of RLC circuits and diodes. Characteristics of elektronik devices.

Compulsory/Recommended Readings:

Sydenham, Peter H.: Introduction to measurement science and engineering, Wiley, 1992

Figliola R.S., Beasley D.E: Theory and Design for Mechanical Measurements, Wiley, 2005

Beckwith T.G., Marangoni R.D., Lienhard J.H.: Mechanical Measurements, Prentice Hall; 2006

MICROCONTROLLER SYSTEMS

INHM821

Topics:

History of microcontrollers. Application fields. Common structure of a 8 bit microcontroller.

Architecture of the MCS48 and MCS51 family, set of commands. Microcontrollers with RISC technology. Properties and set of commands of microcontrollers manufactured by *MICROCHIP*. PIC16F84 type microcontrollers, their hardware and software. Applications (LCD handling, aligning tools with I2C, SPI bus, IP protocol). Structure and programming the Basic Stamp. 8, 16, 32 bit microcontrollers, developing environments.

Compulsory/Recommended Readings:

Morton, J. The PIC Microcontroller: Your Personal Introductory Course, Newnes 2005

Cady, F.M.: Microcontrollers and Microcomputers Principles of Software and Hardware Engineering, Oxford University Press, USA; 2 edition (2009) Wilmshurst T.:

PIC Microcontrollers: Know It All (Newnes Know It All) Newnes 2007

DSP, DIGITAL SIGNAL PROCESSING AND SIGNAL PROCESSORS

INHM831

Topics:

Linear systems and their properties. Fourier series and their properties. Fourier transformation. Convolution, deconvolution. Analog-digital converters. Digital filters. DFT-FFT. Compressing. Digital signal processors (DSP). Structure, properties. Real time signal processing with DSP processors. Getting familiar with DSP systems. Control of A/D, D/A converters. FIR, IIR filters, FFT, compressing: real time coding and decoding.

Compulsory/Recommended Readings:

Andreev Bateman, Iain Paterson-Stephens: THE DSP HANDBOOK
Texas Instruments Handbooks
Steven W. Smith, : The Scientists and engineers guide to Digital Signal processing <http://www.dspguide.com/>

TECHNOLOGICAL IMAGE PROCESSING

INHM601

Topics:

Human and computer vision. Introduction to digital images: sampling, quantization, color images. Introduction to the image processing. Geometrical transformations. Image enhancement: pixel brightness, local preprocessing, image restoration. Linear discrete image transforms (Fourier transform and filtering). Segmentation: thresholding, edge-based segmentation, region growing segmentation, matching. Machine vision.

Compulsory/Recommended Readings:

Image Processing, Analysis, and Machine Vision Milan Sonka, Vaclav Hlavac, and Roger Boyle; Brooks and Cole Publishing (1998)
The following documents are available from the NI home page, or from the Institute of Physics's e-Learning site:
IMAQ Vision Concepts Manual
IMAQ Vision for Labview Users Manual
NI Vision Builder for Automatic Inspection Users Manual

SENSORS AND CONTROLLERS

INHM851

Topics:

Definitions of sensors, groups and properties of the sensors. Sensibility, resolution, noise, reproducibility. Physical basics of the sensors. Detection of temperature, force, pressure, acceleration, conductivity, electromagnetic and ionizing radiation. Chemical signal conversion. Biosensors. Manufacturing of sensors. Categories of sensors. Examples. Application fields of sensors. Remote sensors. Conversion of sensor signals, processing and application in computer aided process control. Main categories of the controllers. Basics of photometric. Active and passive displays. LCD. Image display.

Compulsory/Recommended Readings:

Fraden, Jacob: Handbook of Modern Sensors - Physics, Designs and Applications, Springer, 2004

Jon S. Wilson: Sensor Technology Handbook, Newnes, 2004

Harsányi, G.: Polymer Films in Sensor Applications, Technomic Publishing Co., Lancaster (USA), Basel, 1995.

PRACTICE 1

INHM301

The goals of the subject:

Improving the knowledge gained by fulfilling the main subjects of a specific direction and gathering practical experiences in a personal field of interest of the student by solving real life problems.

After these semesters the students will be in possessions of knowledges of their research fields beyond the average student level. In case of enough advances the subject can serve as the theme of diploma work or PhD work.

Description:

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- The written report of the work of the actual semester (or the presentation of the application) should be handed over by the end of the semester. The scope of the report is about 10 pages.
- Elaborating the subject can be performed in small groups (2-3 persons) as well. In this case the individual work should be evaluated, too. The place of the work could be an external workplace, as well.

Compulsory/Recommended Readings:

According to the guidance of the tutor
According to the research for literature

PRACTICE 2

INHM302

The goals of the subject:

Improving the knowledge gained by fulfilling the main subjects of a specific direction and gathering practical experiences in a personal field of interest of the student by solving real life problems.

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- Elaborating the subject can be performed in small groups (2-3 persons) as well. In this case the individual work should be evaluated, too. The place of the work could be an external workplace, as well.

Compulsory/Recommended Readings:

According to the guidance of the tutor
According to the research for literature

**SPECIALIZATION ORIENTED APPLICATIONS
INHM861**

The goals of the subject:

Improving the knowledge gained by fulfilling the main subjects of a specific direction and gathering practical experiences in a personal field of interest of the student by solving real life problems.

Compulsory/Recommended Readings:

According to the guidance of the tutor

Specialization – Corporate IT Systems

**SYSTEM THEORY
INHE502**

Topics:

This discipline presents the “systematics” of companies to students. It is important to develop

systematic mentality having three important characteristics for experts being engaged in the cases of companies. The description and analysis of companies as whole systems (objects) means the application of the description for analysing total and interactive characteristics and presentation of relations instead of linear description divided to fields (production, marketing, accountance etc.). In accordance with this achievement of the company as a whole system is the most important and this achievement shall be firstly optimized.

Anyway, the main goal is the efficiency of the whole company and not that different parts of the company operate optimally. Therefore the decision-making also takes place in a such a way that the whole system is kept fore instead of decisions made according to smaller subsystems within the company and so the relation of advantages and disadvantages are assessed according to the goals of the company.

Anyway, instead of the analysis of different parts the synthesis (examination of the whole system) shall be applied as a method, because the best solutions of the company are not often determined by the addition of the best (most efficient, quickest and most economic) process of subsystems. The system means the search of order, regularity and processes' freedom of accidentality.

Compulsory/Recommended Readings:

Ludwig von Bertalanffy: General System Theory: Foundations, Development, Applications George Braziller ISBN-10: 0807604534

**PRODUCTION MANAGEMENT
INHE902**

Topics:

Production and operation management (P/OM). Position of P/O/M in economic organizations

and main characteristics of production and service providing. Jobs of the manager in the P/O/M. Decision-making jobs of the manager. History of P/O/M. Production forecast Role of the forecast in P/O/M. Steps of the forecast. Approaches of the forecast. Forecast based on the analysis of time series. Associative forecast techniques. Use of forecast information in the planning of the production (service providing). Relation between the strategy and forecast

Productivity, competitiveness and strategy Selection of the scene. Conception of productivity, approach of productivity and efficiency. Competitiveness, competitors. Formation of the production strategy. Selection of the geographic scene of the production

Planning and selection of processes. Capacity calculation, output data of the planning of the production (service providing). QFD, CAD, Methods of the standardization and process selection, organization of operations. Planning of working jobs. Basic types of the arrangement of the production (service providing). Formation of production cells, formation and counterbalancing of production lines. Leading and control of the production (service providing) Leading strategies. Statistic process control, permanent development Aggregate planning. Goals of the aggregate planning. Strategies for meeting

unbalanced requirements. Preparation of a master plan Reserve economy, reserve economy models. Characteristics of reserves formed on the basis of economic and production aspects. ABC reserve analysis . Establishment of the material necessity of the production, view of the MRP, input-output data of the MRP, establishment of the necessary capacity key elements of the JIT production system. MRP II. KANBAN. Formation method, principles and goals of the formation of the LEAN thin production system. Steps of the formation. Schedule of the production, calculation of the mass-production character of the production. Mass-production, production in big and small series, size of series. Planning of the service for scheduling the production. Queuing models. Queuing strategies. Gauging of the performance (permeability) of the production system. Formation of a planned and accidental queuing system

Compulsory/Recommended Readings:

Production and Operations Management 9. edition by William J. Stevenson
William Stevenson: Operations Management ISBN-10: 0073377848
Joseph Stanislaus Martinich: Production and Operations Management: An Applied Modern Approach ISBN-10: 0471190705

QUALITY MANAGEMENT
INHE522E

Topics:

Quality information, data and characteristics relating to the quality of the product. Goals of the use of quality information. Quality assurance by means of computer CAQ. Scheduled, arranged data collection, structured data supply, acceleration of management and intervention processes, permanent update of the database, automatic preparation of certificates, automation of the documentation, simplification of control activities, rapid elaboration of quality information, rapid reaction to any problems concerning the quality. The role of the SPC (Statistical Process Control) in the quality management system. Gauging and virtual instrumentation by means of computer

Compulsory/Recommended Readings:

Robert T. Amsden: SPC Simplified: Practical Steps to Quality ISBN-10: 0471190705
John S. Oakland: Statistical Process Control, Sixth Edition ISBN-10: 0750669624
Dr. Varga Emilné: Total Quality Management, Ybl Miklós Műszaki Főiskola, Debrecen, 1993.

MANAGEMENT INFORMATION SYSTEMS 1
INHE541

Topics:

Conception of the management information system. Why do Hungarian companies use management information system? Who are the real users of the information system? How can be built-up a management information system? Limit surfaces between the corporate management system (ERP) and management information system, essential differences concerning their use. Technology of management information systems. OLAP

Compulsory/Recommended Readings:

Jane Laudon, Kenneth Laudon: Management Information Systems: Managing the Digital Firm (10th Edition) (Dec 4, 2006)

Effy Oz: Management Information Systems, Sixth Edition Course Technology; 6 edition ISBN-10: 1423901789

Ken Laudon: Management Information Systems Prentice Hall; 11 edition ISBN-10: 013607846X

PRODUCTION INFORMATICS 1

INHE551

Topics:

System technical fundamental conceptions. The industrial company as a complicated system.

Simplified operation model of the company. Conception of the production and fabrication, relations between them. Wider and closer determination of production management. The production management as optimum problem: "production triangular" model. Conception of mechanical engineering technology. Interior hierarchy of production systems. Levels of the planning of the production management and technological planning. relation between levels Conception of the way of machining. Classification of technological processes. Technological graphs and their application. Heuristic principle of two-step process optimization.

PLC programming

Compulsory/Recommended Readings:

Frank Plonka, Gustav J. Olling: Computer Applications in Production and Engineering (IFIP International Federation for Information Processing) (1997),

Mikell P.: Groover Automation, Production Systems, and Computer-Integrated Manufacturing (3rd Edition) (Aug 3, 2007)

Russel Biekert: Cim Technology: Fundamentals and Applications Goodheart Wilcox Company ISBN-10: 156637426X

James A. Rehg: Introduction to Robotics in CIM Systems Prentice Hall; 5 edition ISBN-10: 0130602434

Robot Programming : A Practical Guide to Behavior-Based Robotics McGraw- Hill/TAB Electronics; 1 edition ISBN-10: 0071427783

MANAGEMENT INFORMATION SYSTEMS 2

INHE542

Topics:

Information support of the strategic management. Process of the introduction of management information systems Business intelligence and its applications Business Objects.

Compulsory/Recommended Readings:

Effy Oz: Management Information Systems, Sixth Edition Course Technology; 6 edition ISBN-10: 1423901789

Ken Laudon: Management Information Systems Prentice Hall; 11 edition ISBN-10: 013607846X

Cindi Howson: BusinessObjects XI (Release 2): The Complete Reference McGraw-Hill Osborne Media ISBN-10: 00722626

PRODUCTION INFORMATICS 2.

INHE552

Topics:

Typical jobs concerning the operational sequence planning, planning of operations and operation elements. Jobs concerning the optimization of the data of a one-tool machining. Method based on the intensity of material detaching. Methods of the technological planning and knowledge representation. Scope of conceptions of the group technology and limits between them. Basic conceptions of the numeric control (NC); manual and computerized programming. Scope of conceptions of computer integrated machining (CIM) and limits between them. Production management jobs.

Robot programming

Compulsory/Recommended Readings:

Russel Biekert: Cim Technology: Fundamentals and Applications Goodheart Wilcox Company ISBN-10: 156637426X

James A. Rehg: Introduction to Robotics in CIM Systems Prentice Hall; 5 edition ISBN-10: 0130602434

Robot Programming : A Practical Guide to Behavior-Based Robotics McGraw- Hill/TAB Electronics; 1 edition ISBN-10: 0071427783

OFFICE WORK AUTOMATION

INHE561

Topics:

Integrated components of the automatic office work Document Manager for Exchange (DMX) management of documents prepared in processes of the general management of affairs, company regulation, documentation for managing orders and dispositions in controlled circumstances (check-in, check-out)

Monitoring and storage of versions and life-story Work folder for Exchange (WFX) handling of working processes (workflow). Electronic document folders and document groups for storing documents and orders Automatic merge of Offline modifications Imaging for Windows Professional (IWP) for processing files or fax messages (scanning by means of a table scanner, indexing, storage). Tools for improving the quality of the photo (straightening of inclines, noise elimination, cutting of certain parts of the photo) (INHox) Automatic processing of received electronic fax messages Digitalization and storage of paper-based files and fax messages in a document management system. Management of electronic documents (controlled documentation, versions' monitoring, data concerning the life-story). Inside Exchange Site, accessing of managed documents from other Exchange Sites (in the same Exchange Organization). Assurance of the information background of complex jobs (management of documents, jobs, deadlines and responsible persons, forum for debates)

Handling of working processes by means of team work tools.

Compulsory/Recommended Readings:

Microsoft Exchange Server 5.5 Series - Concepts and Administration
Microsoft Exchange Server 5.5 Series - Design and Implementation
Core Technologies of Microsoft Exchange Server 2010 (upgrade)
Installing and Configuring Microsoft Exchange Server 2010 (upgrade)

**PROJECT MANAGEMENT
INHE571**

Topics:

Conception of project, determination of the goals of a project, evaluation of the goals of the project, project definition. Schedule and network planning methods. Composition of WBS. Composition of a logic diagrams
Denomination of responsible persons and determination of deadlines. Critical way calculation in the project. Schedule in the project. Sources' allocation in the project. Costs' calculation in the project
Preparation of a computerized project plan. Closing of a project plan. Control and monitoring of the progress of the project. Computerized planning and monitoring of the project

Compulsory/Recommended Readings:

Eric Verzuh: The Fast Forward MBA in Project Management Wiley ISBN-10: 0470247894
Berkun Scott: The Art of Project Management (Theory in Practice (O'Reilly)), O'Reilly Media; 1 edition (2005)

**PRACTICE 1
INHE531**

Topics:

The deepening of knowledge obtain in the professional field and obtainment of practical experiences in a smaller topic in which the student is interested during the solving of real engineering – information jobs.

The main goal is for the student to obtain knowledge in the certain professional field exceeding the average knowledge level and the work performed in the framework of the discipline to use as degree work or doctoral dissertation in the case of an appropriate headway.

Compulsory/Recommended Readings:

According to the guidance of the tutor
According to the research for literature

PRACTICE 2
INHE532

Topics:

The deepening of knowledge obtained in the professional field and obtaining of practical experiences in a smaller topic in which the student is interested during the solving of real engineering – information jobs.

The main goal is for the student to obtain knowledge in the certain professional field exceeding the average knowledge level and the work performed in the framework of the discipline to use as degree work or doctoral dissertation in the case of an appropriate headway.

Compulsory/Recommended Readings:

According to the guidance of the tutor

According to the research for literature

Economical and Human Knowledges

SOCIOLOGY
INHK902

Topics:

Social structure. Operation of the society. Economy and society. Social requirements and exports.

Law, moral, politics. Constitutional basic laws. Education of exports – social requirements. Relation of social interest and scenes of social activity.

Organization and society (social environment, social determination). Types of organization. Organization and bureaucracy.

State and politics. Political parties, movements and social interest defending systems. Power and legitimation. Power and domination. Decision-making mechanisms. Democracy and dictatorship. Parliamentary system models. History and formal changes of the parliamentary system.

Main tendencies of the social development.

International relations and today's global problems. Knowledge concerning the EU and its operation

Compulsory/Recommended Readings:

John Pinder and Simon Usherwood: The european union: a very short introduction (very short introductions)

John McCormick: Understanding the european union: a concise introduction
Palgrave

Macmillan; Fourth Edition, Revised and Updated edition ISBN-10: 0230201024

ECONOMY FOR ENGINEERS
INHK912

Topics:

Macro-economy:

The subject-matter of economics in the system of sciences. Fundamental conceptions and processes of macro-economy. Operation of macro-organizations. System and statutory formalities of macro-relations. Macro-conception of production, sources, market, price and money in macro-organizations. World economic processes.

Micro-economy: Role of micro-economic processes and organizations in economic life. Operation of the budget, non-profit organizations, public utility companies and enterprises. Macro-conception of production, sources, market, price and money in micro-organizations.

Compulsory/Recommended Readings:

Samuelson - Nordhaus: Economy I. (2003)

Samuelson - Nordhaus: Economy II. (2003)

Samuelson - Nordhaus: Economy III. (2003)

ECONOMICAL PROCESSES OF ENTERPRISES

INHK922

Topics:

Economic purposes and tools of a company-enterprise. System of company's sources.

Financial sources. Raw materials. Labour. Operation of the service providing company. Service providing system of the company production service providing activity. File system. Efficiency requirements. Economic analysis methods of the company. Information systems in the enterprise. Relation between enterprises and market. System of the co-operations of enterprises. Clusters, industrial parks and logistic systems. Financial system of enterprises. System of files, reports and financial sources. Application and public procurement.

Compulsory/Recommended Readings:

Gunyung Lee: Business Process Management of Japanese and Korean Companies (Modern Institute of Management Japanese Management and International Studies) ISBN-10: 9812838600

Rob Lebow: Lasting Change: The Shared Values Process That Makes Companies Great ISBN-10: 0471328472

BASICS OF MANAGEMENT FOR ENGINEERS

INHK932

Topics:

System planning, human sources' management, risk and reliability, quantitative methods, marketing, management, non-profit organizations' management, production management, changes' management, project management, company communication, strategic management, technology management, organization of investments. Structure and operation of enterprises, processes, their examination and analysis

Introduction into the processes planning management. Analysis of the whole process including the relations between owners, investors, material sources, planners, executors and users. Preparation of schedules. Realization's analysis, human factors and information applications.

Basic theories of decision-making. Logic of decision-makers, value of information. Decision-making methods, their preliminary and subsequent analysis.

Case studies.

Compulsory/Recommended Readings:

Johny V. Chelsom: Management for Engineers, Scientists and Technologists ISBN-10: 0470021268

Berkun Scott: The Art of Project Management (Theory in Practice (O'Reilly)), O'Reilly Media; 1 edition (2005)

**THE BASES OF QUALITY MANAGEMENT
INHK942**

Topics:

History of the quality improving movement. Formation of the quality management system.

Characteristics of quality management systems. Main phase of the development of quality management.

Process of building-up a quality management system and its documentation system. Main characteristics and most important elements of ISO 9000 standard system. Conception and most important elements of ISO 9001:2000 standard. Building-up a quality management system and its documentation of an audit. Role played by the ISO 9001:2000 standard in the increase of the efficiency of the Conception, principles and elements of TQM. Most important tools of TQM. Application of TQM conceptions. Step towards the high-quality. Relation between TQM and quality price models (EFQM). Role and relation of the ISO 9000 standard system and TQM in the development of quality management systems. Steps towards the integrated quality management systems. Questions concerning the elaboration and application of the integrated quality management system.

Compulsory/Recommended Readings:

John Bank: The Essence of Total Quality Management, USA (1992)

David Hoyle :Quality Management Essentials Butterworth-Heinemann ISBN-10: 0750667869

**LAW AND STATE ADMINISTRATION
INHK952**

Topics:

Legal fundamental conceptions, Constitution of the Republic of Hungary, propriety basic

knowledge, register of real estates, forms of responsibility, general characteristics of contracts and most frequent contracts of economic life.

Main characteristics of the EU law practice

Conception, job and structure of administration. Types of administration's acts.
Legal rules of different phases of an administrative process (procedure of first instance, legal remedies, execution)

Compulsory/Recommended Readings:

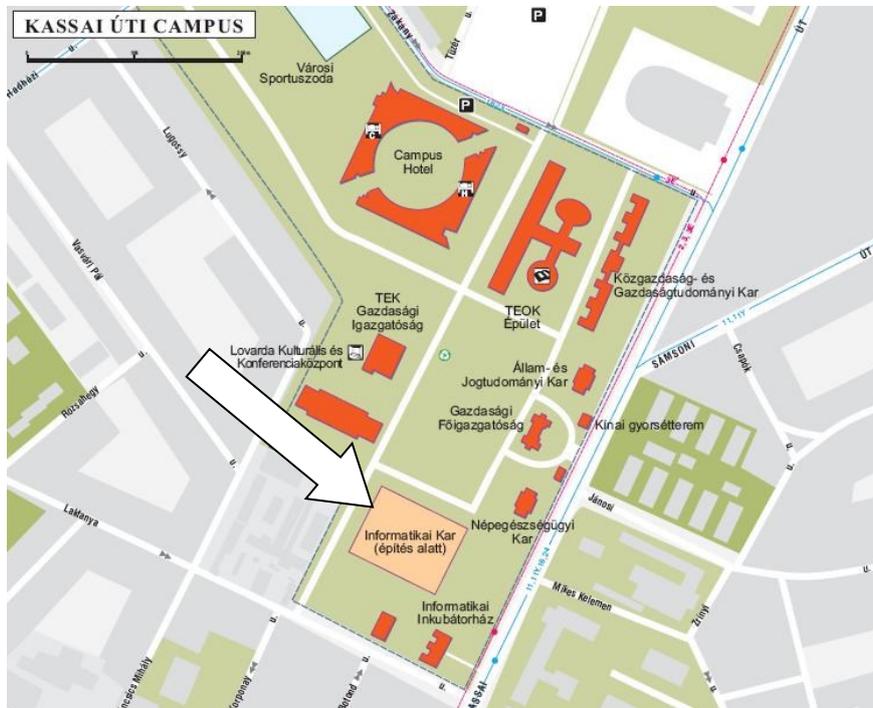
Jo Steiner: EU Law Oxford University Press, USA ISBN-10: 0199219079

Hans Kelsen: General Theory of Law and State, The Lawbook Exchange, Ltd. (2007)

Andrea Biondi, Piet Eeckhout, James Flynn: The Law of State Aid in the European Union, Oxford University Press, USA (2004)

The map of the campus

The new building of Faculty of Informatics at Kassai Campus



Photos



The largest lecture hall for 196 persons



Seminar room



Inside the building



“Green wave” park in front of our building



Professional Student's Days at Faculty







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