

UNIVERSITY OF DEBRECEN
FACULTY OF INFORMATICS



BSc degree courses
MSc degree courses
PhD courses
Research

Engineering Information Technology BSc

2011



Address: 4032 Debrecen Egyetem tér 1, Hungary

Correspondence: H-4010 Debrecen P.O. Box 95, Hungary

Phone: +36 52 518 655

Fax: +36 52 518 623

E-mail: englishstudies@detek.unideb.hu

Web: <http://englishstudies.sci.unideb.hu>



Contents

FOREWORD BY THE DEAN	4
UNIVERSITY OF DEBRECEN	5
FACULTY OF INFORMATICS	6
<i>Computer equipment at the Faculty</i>	7
<i>The data network</i>	7
BSC DEGREE COURSES	8
<i>Software Information Technology</i>	8
<i>Engineering Information Technology</i>	8
<i>Business Information Technology</i>	9
<i>Library and Information Science</i>	9
MASTER'S DEGREE COURSES	10
<i>Software Information Technology</i>	10
<i>Business Information Technology</i>	10
<i>Library Information Sciences</i>	11
<i>Teacher – Teacher of Informatics</i>	11
<i>Teacher – Teacher of Library-pedagogy</i>	11
PHD COURSES	12
CISCO REGIONAL ACADEMY	13
RESEARCH	15
<i>Periodicals</i>	15
THE BÉLA GYIRES IT LECTURES	16
DEPARTMENTS	17
<i>Department of Applied Mathematics and Probability Theory</i>	17
<i>Department of Informatics Systems and Networks</i>	17
<i>Department of Information Technology</i>	18
<i>Department of Computer Science</i>	18
<i>Department of the Computer Graphics and Image Processing</i>	19
<i>Department of Library Informatics</i>	19
<i>Affiliated Department of ICT Systems Operation</i>	19
ENGINEERING INFORMATION TECHNOLOGY	20
<i>Natural Science and basic vocational training</i>	20
<i>Economical and human knowledges</i>	22
<i>Specialization - Infocommunication Networks</i>	22
ENGINEERING INFORMATION TECHNOLOGY BSC SUBJECT PROGRAMS	23
THE MAP OF THE CAMPUS	41

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 has 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 projects, and work as closely as possible with local enterprises.

Sincerely,

Dr. György Terdik, 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 34,000 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 in 2010.

Faculty of Informatics

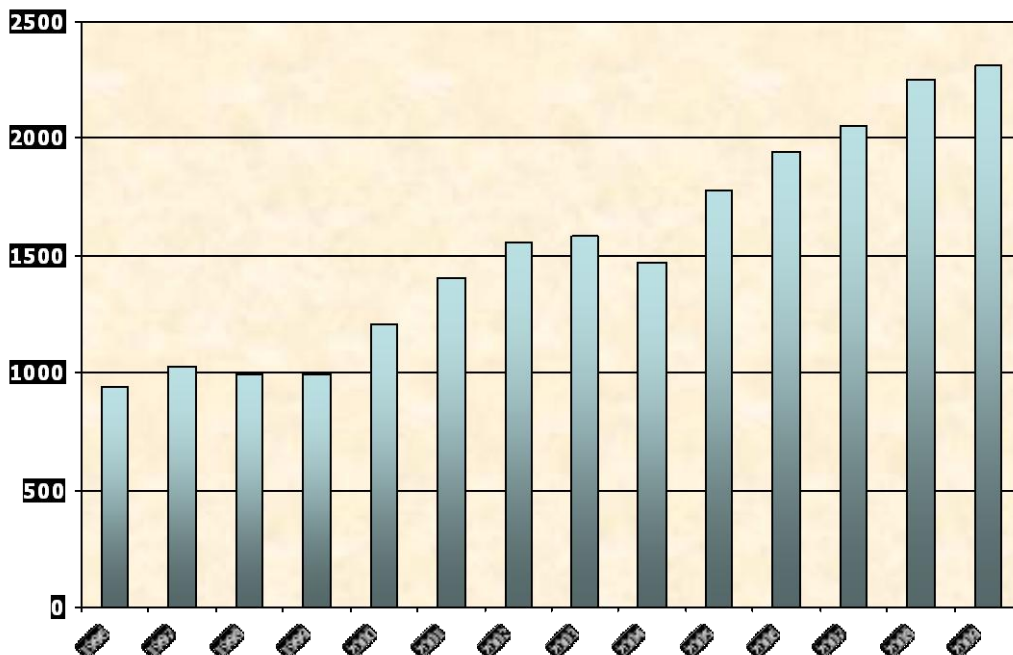


The **Faculty of Informatics** at the **University of Debrecen** boasts the only accredited university-level educational program for IT specialists in the east-Hungarian region. The six professors, 19 associate professors (senior staff), 29 assistant professors (staff), 16 teaching assistants and 5 graduate 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 increases every year. There are currently around 2,300 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



The Faculty has 42 rooms in the shared building. We have 10 well equipped computer laboratories. There are possibilities to use computers free in libraries and other labs.

The data network

The building is equipped with a high-speed data network constructed from structured, cross-wired EIA/TIA cabling with a bandwidth of 100 Mbit/s. The cables run from 500 end-points to converge in two rack cabinets. The bulk of data traffic is controlled by 100 Mbit manageable network switches, which are in turn linked via a 100 Mbit connection to a central switch, which connects to the University's backbone at 2*1 Gbit/s.

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

At present, some 430 desktop PCs and 60 portable computers (notebooks) are connected to the Faculty's network.

The majority of computers in the classrooms are Intel Pentium IV-based, and connect to the Faculty's LAN with 100 Mbit/s network adapters. All computer laboratories are equipped by overhead projectors and we have 3 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 work of students and teachers alike is greatly assisted by the extremely well-stocked – even by international standards – library of specialist literature, operated jointly with the Institute of Mathematics, as well as the books and other supplementary educational materials continuously developed in-house by the Faculty staff, which are also accessible online.



BSc Degree Courses

Software Information Technology

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

Engineering Information Technology

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 Information Technology

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

Master's Degree Courses

Software Information Technology

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
7. Hardware Programming

Business Information Technology

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

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

Course in Hungarian

Teacher – Teacher of Library-pedagogy

Course in Hungarian

PhD Courses

PhD School of Informatics

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

Programs:

- Fundamentals of Informatics (Leader: Dr. Pál Dömösi, DSc, full professor)
- Discret Mathematics, Image processing and computer geometry (Leader: Dr. Péter Tibor Nagy, DSc, full professor)
- (Leader: Dr. Mátyás Arató, DSc, professor emeritus)
- Digital Communication (Leader: Dr. Attila Pethő, DSc, full professor)
- Information Systems and Networks (Leader: Dr. János Sztrik, DSc, full professor)
- Applied Information Technology and its theoretical backgrounds (Leader: Dr. György Terdik, DSc, full professor)

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

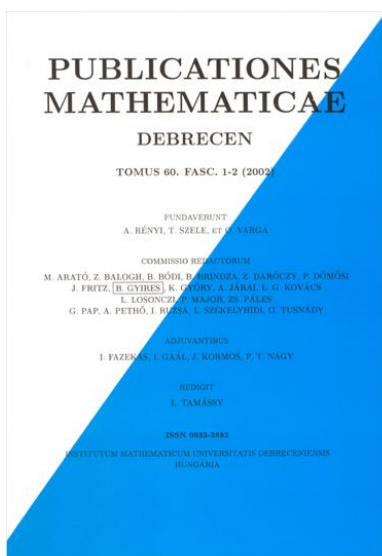
The scientific research conducted at the Faculty of Informatics has steadily broadened in scope and increased in depth over the past decades. Our international reputation for excellence has been further strengthened by the work of our leading scientists in the following areas: stochastic processes and 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

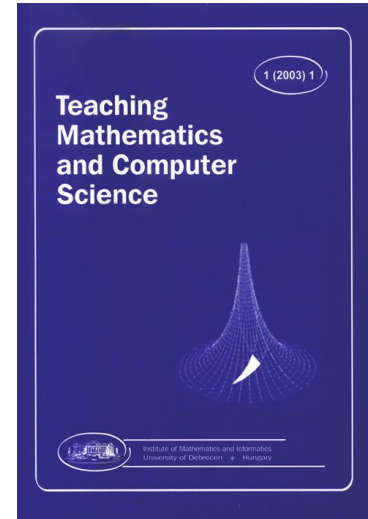


Publicationes Mathematicae Debrecen

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



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 was introduced. He was the highly regarded

and much loved 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://www.inf.unideb.hu/valseg/index_angol.html

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: jsztrik@inf.unideb.hu

www: http://irh.inf.unideb.hu/english/index_angol.htm

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 György Terdik, Full professor

Email: terdik.gyorgy@inf.unideb.hu

www: <http://infotech.inf.unideb.hu/index.html>

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. Attila Pethő Full professor, corresponding member of Hungarian Academy of Sciences

Email: petho.attila@inf.unideb.hu

www: <http://www.inf.unideb.hu/szamtud/>

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 automatons
- 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://www.inf.unideb.hu/grafika/main_e.html

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://www.inf.unideb.hu/~bodai/kinformatika/>

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: Péter Ilosvai

Email: peter.ilosvai@it-services.hu

www: <http://www.it-services.hu/index.php?content=64>

Engineering Information Technology

BSc Course

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

Natural Science and basic vocational training

Code	Subject	Credit	Hrs per week			Exam	Prere- quisites	Period	Seme- ster
			Th.	Practice					
				CR	CL				
INHK101	Discrete Mathematics 1	4	2	2		K		1	1
INHK111	Calculus 1	4	2	2		K		1	1
INHK201	Introduction to Informatics	4	2		2	K		1	1
INHK401	Logic in Computer Science	4	2	2		K		1	1
INHK701	Computer Architectures	3	2			K		1	1
INHK801	Physics 1	4	3		1	K		1	1
INHK811	Electronics 1	3	3			K		1	1
INHK102	Discrete Mathematics 2	4	2	2		K	INHK101	2	2
INHK112	Calculus 2	4	2	2		K	INHK111	2	2
INHK421	Data Structures and Algorithms	4	2	2		K	INHK201	2	2
INHK301	Programming Languages 1	5	2		2	K	INHK201	2	2

Code	Subject	Credit	Hrs per week			Exam	Prere- quisites	Period	Seme- ster
			Th.	Practice					
				CR	CL				
INHK211	Operating Systems	4	2		2	K	INHK201	2	2
INHK802	Physics 2	4	3		1	K	INHK801	2	2
INHK812	Electronics 2	2	2			K	INHK811	2	2
INHK831	Digital Technologies	2	2			K	INHK811	2	2
INHK302	Programming Languages 2	5	2		2	K	INHK421 INHK301	1	3
INHK501	Database Systems	5	2		2	K	INHK401 INHK421 INHK301	1	3
INHK601	Introduction to Computer Graphics	4	2		2	K	INHK101 INHK301	1	3
INHK121	Probability Theory and Mathematical Statistics	4	2	2		K	INHK102 INHK112	1	3
INHK821	Signals and Systems	2	2			K	INHK111	1	3
INHK721	Computer Network Architectures and Protocols	4	2		2	K	INHK102 INHK112 INHK301 INHK211	1	3
INHK001	Comprehensive Exam	0				CE	INHK302 INHK501	F	3
INHK813	Practice in Electronics	2			2	P	INHK801 INHK812	2	4
INHK431	Theory of Computing	3	2			K	INHK401	2	4
INHK311	Practice in Programming 1	6			6	P	INHK302	2	4
INHK441	Introduction to Artificial Intelligence	5	2	2		K	INHK302 OR (INHK301 AND INHK401)	2	4
INHK511	Enterprise Information Systems	2	2			K		2	4
INHK521	Modelling and Analysis of Information Technology Systems	2	2			K	INHK121	2	4
INHK451	Foundation of Computer Security	2	2			K	INHK102	2	4
INHK841	Technology of Control	4	2		2	K	INHK821	2	4
INHK522	Models of Enterprise Information Systems	2			2	P	INHK511	1	5
INHK312	Practice in Programming 2	2			2	P	INHK311	1	5
INHK531	Decision Support Systems	2	2			K	INHK501	2	6
INHS001	Theses 1	5				P	INHK302 INHK501	F	6
INHS002	Theses 2	10				P	INHK302 INHK501	F	7

Economical and human knowledges

Code	Subject	Credit	Hrs per week			Exam	Prere- quisites	Period	Seme- ster
			Th.	Practice					
				CR	CL				
INHk901	Economics	4	2	2		K		1	1
INHk911	Economics of Enterprises	2	2			K	INHk901E	2	2
INHk921	Knowledges of Law and State	2	2			K	INHk911E	1	3
INHk931	EU knowledges	2	2			K	INHk921E	2	4
INHk941	Management	2	2			K	INHk921E	2	4
	Compulsory choice 1	2	2			K		1	5
	Free choice 1	2	2			K		1	5
	Compulsory choice 2	2	2			K		2	6
	Free choice 2	2	2			K		2	6

Specialization - Infocommunication Networks

Code	Subject	Credit	Hrs per week			Exam	Prere- quisites	Period	Seme- ster
			Th.	Practice					
				CR	CL				
INHC701	Telecommunication Systems	6	4		2	K	INHk841	1	5
INHC711	Performance Analysis of Infocommunication Networks	4	4			K	INHk521	1	5
INHC301	Practice 1	2			2	P	INHk301	1	5
INHC721	Introduction to Programming of Cisco Devices 1	4	2		2	K	INHk721	1	5
	Free choice 1	6						1	5
INHC401	Information and Coding Theory	4	4			K	INHk121	2	6
INHC411	Data Security	6	4		2	K	INHk451	2	6
INHC302	Practice 2	4				P	INHC301	2	6
INHC722	Introduction to Programming of Cisco Devices 2	4	2		2	K	INHC721	2	6
	Free choice 2	4						2	6
INHC731	High-Speed Networks	4	4			K	INHk721	1	7
INHC601	Multimedia	6	4		2	K	INHk001	1	7
INHC303	Practice 3	4				P	INHC302	1	7
	Free choice 3	4						1	7

Exam: K – kollokvium
 CE – comprehensive exam
 P – practical sign

Engineering Information Technology BSc Subject programs

DISCRETE MATHEMATICS 1 INHK101

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. Generator function.

Finite-dimensional vector spaces, subspace, linear independence, basis, dimension,. Matrix algebra; invertibility of matrices, rank. Properties of determinants, formula to expand the determinant along a row or column, theory of product matrix product theorem. Solvability assumptions of homogeneous and inhomogeneous systems of linear equations, characterization solution set, determing of general solution.

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.
-

**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.
-

**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:

- Dragálin Albert, Buzási Szvetlána: Bevezetés a matematikai logikába, Kossuth Egyetemi Kiadó, Debrecen, 1986.
 - Pásztorné Varga Katalin: Matematikai logika alkalmazásokhoz (Matematikai logika – számítástudomány), ELTE, egyetemi jegyzet, Budapest, 1997.
 - Pásztorné Varga Katalin, Várterész Magda: A matematikai logika alkalmazásszemléletű tárgyalása, Panem Kiadó, Budapest, 2003.
 - Szendrei Ágnes: Diszkrét matematika, Polygon Kiadó, Szeged, 1994.
-

COMPUTER ARCHITECTURES INH701

Topics:

Computer generations, the internal architecture of a computer: storage, control unit, processor, I/O system, channel, system bus. General microprocessor model. Logical operations and values, logical functions. Graphic minimization, Weitch- Karnaugh tableau. Simple combination logical networks: multiplexer, demultiplexer, encoder, decoder, code converters, comparers, parity check units, summation units. Hazards at logical circuits. Basic ordering units: RS flip-flop, JK flip-flop, T flip-flop, D flip-flop. Multivibrators, registers. Synchronized and asynchronized counters. Semiconductor memories: classification and operation principles. Classification and implementation of machine level commands, memory and I/O cycles. Machine level control transfer, processor controlled and independent states. The I/O system. AD and DA converters, serial and parallel adapters. Character oriented and graphic picture presentation. Pheripheries: keyboards, mouse, scanners, printers. Secondary storages: fixed disks, tapes, optical storages. Computer classification: SISD, SIMD, MISD, MIMD, RISC, CISC computers. Transputers. Parallelism, super scalar architecture, multiprocessor systems, vector computers. Dataflow computers.

Compulsory/Recommended Readings:

- Patterson D.A., Henessy J.L.: Computer organization & Design, Morgan Kaufmann Publ. (2 ed.) 1998.
- Rob Williams: Computer System Architecture (A Networking Approach), Addison Wesley, 2001.

PHYSICS 1. INH801

Topics:

Physical concepts and quantities, systems of units. Description of motion of point particle. The concepts of mass and moment, the conservation of moment. Newton's laws, force laws and their simple applications: throws, harmonic motions. The Galilei principle, 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 1st law of the thermodynamics, specific heat. Reversible and irreversible processes. Heat engines and refrigerators. The 2nd 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, the Maxwell-Boltzmann distribution. The concept of statistical weight. Statistical interpretation of entropy; free energy and free enthalpy. Phase transitions, chemical potential. 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.
- Dede M.: Kísérleti fizika 1. kötet, egyetemi jegyzet.
- Dede M., Demény A.: Kísérleti fizika 2. kötet, egyetemi jegyzet.

ELECTRONICS 1

INHK811

Topics:

Characteristics of passive electronic components; Passive RC circuits; 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
- U.Tietze – C. Schenk : Analóg és digitális áramkörök, Műszaki könyvkiadó, Budapest 2001
- K. Beuth: Az elektronika alapjai I - II , Műszaki könyvkiadó, Budapest 1994
- Kovács Csongor: Elektronika, General Press Kiadó
- Gergely István: Elektrotechnika, General Press Kiadó

DISCRETE MATHEMATICS 2

INHK102

Topics:

Linear mappings of finite dimensional vector spaces; properties of mapping, matrix representation. Scalar product. Cauchy-Schwarz inequality. Orthonormality, norm. Self-adjointed and unitary matrices. Characteristic root, characteristic vector, invariant subspaces. Jordan normal form of matrices. Quadratic forms, canonical form.

Combinatorial probability. Total probability, Bayes's theorem. Discrete distributions. Expected value, standard deviation. Law of large numbers.

Elements of mathematical statistics. Mean, standard deviation; usage of tables.

Fundamentals of graph theory. Graphs, oriented graphs, matrix representation, routes, cycles, special graphs and their properties.

Fundamentals of coding theory. Dissolvable, prefix codes. Optimal code, entropy, information. Huffman code. Hamming distance, error-correcting code, decoding methods. Linear codes.

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.
- Lang, S.: Algebra. Addison-Wesley, Reading – London, 1969.
- 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 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, 2000.

**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. NT, 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. The concept of the magnetic field and the definition of magnetic field inductance 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. 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.
- Hevessy I.: Elektromosságtan I., egyetemi jegyzet.
- Hevessy I.: Elektromosságtan II., egyetemi jegyzet.

**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
- U.Tietze – C. Schenk : Analóg és digitális áramkörök, Műszaki könyvkiadó, Budapest 2001
- Kovács Csongor: Elektronika, General Press Kiadó
- Gergely István: Elektrotechnika, General Press Kiadó

**DIGITAL TECHNOLOGIES
INHk831**

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. 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:

- U.Tietze – C. Schenk : Analóg és digitális áramkörök, Műszaki Kk. Budapest 2001
- K. Beuth: Az elektronika alapjai III, Műszaki Könyvkiadó, Budapest 1994
- Horowitz-Hill : The Art of Electronics, Cambridge University Press, 1989

PROGRAMMING LANGUAGES 2
INHK302

Topics:

The object oriented paradigm: class, object, encapsulation, visibility, inheritance, polymorphism, early and late binding, messages. Classification of object oriented programming languages. Imperative object oriented programming languages (Java, C#, Eiffel, Smalltalk). The functional paradigm. First-class function values and higher-order functions, recursion, structured functions. LISP, CLOS. The logic paradigm. Prolog.

Compulsory/Recommended Readings:

- R.W. Sebesta, Concepts of Programming Languages. Addison-Wesley, 2006.
- M. L. Scott, Programming Language Pragmatics. Morgan Kaufmann, 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

INTRODUCTION TO COMPUTER GRAPHICS INHK601

Topics:

Graphics hardware, graphical standards, SRGP, simple raster graphic algorithms, geometrical transformations, parallel, central and axonometric projections, approximations and interpolations of curves, representing surfaces, solid modelling, hidden line and hidden surface techniques.

Compulsory/Recommended Readings:

- FOLEY, J.,D., van DAM, A., FEINER, S.,K., HUGHES, J.,F. : Computer Graphics, Principles and Practice, Second edition in C, Addison-Wesley, Reading, Mass., 1996.
 - ROGERS,D.F., ADAMS,J.A.: Mathematical elements for Computer Graphics, Mc Graw-Hill, New York, 1976., 2.nd.ed. 1990.
 - WATT, Alan: 3D Computer Graphics, Addison-Wesley, Wokingham, England, 1993.
-

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 INHK821

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, 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 continues discrete systems.

Compulsory/Recommended Readings:

- Fodor György Hálózatok és rendszerek analízise
- Fodor György Jelek, rendszerek és hálózatok

**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
INH813**

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:

- Oláh L. : Analóg elektronika laboratóriumi gyakorlatok, hallgatói jegyzet, DE-TTK, Kís.Fiz.Tsz. könyvtár
- Sztaricskai T.-Vas L.: Elektronikus laboratóriumi mérések, hallgatói jegyzet, DE-TTK, Kís.Fiz.Tsz. könyvtár

THEORY OF COMPUTING INH431

Topics:

Turing machines and their time and space complexity. Simulation, theorem on simulation. Recursive and recursively enumerable languages and the relation between these language classes. Notion and existence of universal Turing-machines. The thesis of Church. Algorithmically unsolvable problem. Halting problem. RAM machines. Kolmogorov complexity and its application. Complexity classes. Non-deterministic Turing machines. The space-time theorem. Relation between the complexity classes of P and NP. The witness theorem. Examples for languages belonging to the NP class. NP complete problems. The SAT language and other NP complete languages. Basic notions of cryptography.

Compulsory/Recommended Readings:

- C. H. Papadimitriou: Computational complexity, Addison Wesley, 1994.
 - T. H. Cormen, C. E. Leiserson, R.L. Rivest: Introduction to algorithms, MIT Press, Cambridge, Massachusetts, 1990.
-

PRACTICE IN PROGRAMMING 1 INH311

Topics:

Translators and interpreters. Implementation of programming languages. Integrated development environments (IDE). Language sensitive editors. Control of the process of translation. Libraries. Testing, debugging. Process oriented, object oriented environments. CASE tools, WEB interfaces.

Compulsory/Recommended Readings:

- W. R. Stevens: Advanced programming in the UNIX environment. Addison Wesley, 1993.
 - C. Petzold: Programming Windows. Microsoft Press, 1998.
-

INTRODUCTION TO ARTIFICIAL INTELLIGENCE INH441

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. Russell, P. Norvig, *Artificial Intelligence, A Modern Approach*, Prentice-Hall, 1995.
-

ENTERPRISE INFORMATION SYSTEMS INHK511

Topics:

The tasks of the informational system: production management, the definition of production manners, substance and semi-finished product claims, capacity calculation, production programming, timing, production preparation, remittance, production settlement, stockpiling, staff system. An informational support is necessary to the function.

Compulsory/Recommended Readings:

- Enterprise Information Systems by James A. O'Brien (Jun 22, 2007),
 - Introduction to Information Systems: Supporting and Transforming Business by R. Kelly, Jr. Rainer, Efraim Turban, and Richard E. Potter (- Jan 17, 2006)
-

MODELLING AND ANALYSIS OF INFORMATION TECHNOLOGY SYSTEMS INHK521

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:

- Buttyán Levente és Vajda István, Kriptográfia és alkalmazásai, Tiptex, 2004. ISBN: 963 9326 13 8
 - Ködmön József, Kriptográfia, ComputerBooks, 2000.
 - Pieprzyk, Josef, Hardjono, Thomas, Seberry, Jennifer , Fundamentals of Computer Security, 2003, ISBN: 3-540-43101-2
-

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. 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:

- Mórocz I.: Irányítástechnika I. KKMF 1164, Bp., 1998
 - Fehér Gy.: Szimuláció a gyakorlatban, mechatronikai rendszerek szimulációja I. 1997
 - Kóré L.: Szimuláció a gyakorlatban, mechatronikai rendszerek szimulációja II. 1997
-

MODELS OF ENTERPRISE INFORMATION SYSTEMS INHK522

Topics:

The modeling of corporate informational systems, his simulation. The performing ability of corporate informational systems, the measurement of the efficiency, performance analysis, load generating. The reliability of corporate infromational systems, mistake models, the measures of the system reliability. The construction of fault-tolerant systems. Are an analyst and a simulation analysis. Systems the protection of information, computerised safety technology.

Compulsory/Recommended Readings:

- Enterprise Information Systems by James A. O'Brien (Jun 22, 2007),
 - Introduction to Information Systems: Supporting and Transforming Business by R. Kelly, Jr. Rainer, Efraim Turban, and Richard E. Potter (Jan 17, 2006),
 - Modelling and Analysis of Enterprise Information Systems, Modelling and Analysis of Enterprise Information Systems by Angappa Gunasekaran (Mar 30, 2007)
-

PRACTICE IN PROGRAMMING 2 INHK312

Topics:

Challenge and answers of software chrisis. Modular, structured and object oriented programming methods. Formal program developement. Abstraction. Patterns in programming. Components. Testing, validation. „Good” style of programming. Metrics of softwares. Qualiti assurance of softwares.

Compulsory/Recommended Readings:

- Ian Sommerville: Software Engineering (7th editon)
 - D. Galin: Software Quality Assurance: From Theory to Implementation. Addison Wesley, 2004, ISBN 0-201-70945-7.
-

DECISION SUPPORT SYSTEMS INH531

Topics:

The rules of the decision making. He is the general principle of the decisions. Are the decision analysis and the decision making. Can be programmed and decisions which cannot be programme. Vague and risky decisions. The representation of the risk and insecurity. They are decision making procedures. He is decision making in a vague situation. Decision making is risky between circumstances. He is the decision matrix. The decision tree. The usefulness is his concept and his definition. He is collective decision making. They are collective decision making strategies. They are collective decision making methods.

Compulsory/Recommended Readings:

- Decision Support Systems (2nd Edition) by George M. Marakas (Sep 2, 2002),
- Decision Support and Business Intelligence Systems (8th Edition) by Efraim Turban, Jay E Aronson, Ting-Peng Liang, and Ramesh Sharda (Dec 28, 2006)

Specialization - Infocommunication Networks

TELECOMMUNICATION SYSTEMS INHC701

Topics:

Physical transmissions: wired, wireless, transmission on ground and via satellite. 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:

- "TÁVKÖZLŐ HÁLÓZATOK ÉS INFORMATIKAI SZOLGÁLTATÁSOK" , a hírközlési és informatikai egyerület online könyve. Főszerkesztő dr Lajta György <http://www.hte.hu/onlinekonyv.html>
- Dr. Henk Tamás, Németh Krisztián „Távközlő hálózatok” BME-TMIT jegyzet

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 Chans, 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
-

**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 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:

- The students should choose the subject of this three-semester course after careful considerations. The departements 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 developepment 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 th eend 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
-

**INFORMATION AND CODING THEORY
INHC401**

Topics:

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

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.
- Hankersson, 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:

- Buttyán Levente és Vajda István, Kriptográfia és alkalmazásai, Tiptex, 2004. ISBN: 963 9326 13 8
- Ködmön József, Kriptográfia, ComputerBooks, 2000.
- Pieprzyk, Josef, Hardjono, Thomas, Seberry, Jennifer , Fundamentals of Computer Security, 2003, ISBN: 3-540-43101-2

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 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
-

**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 3
INHC303**

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.
-

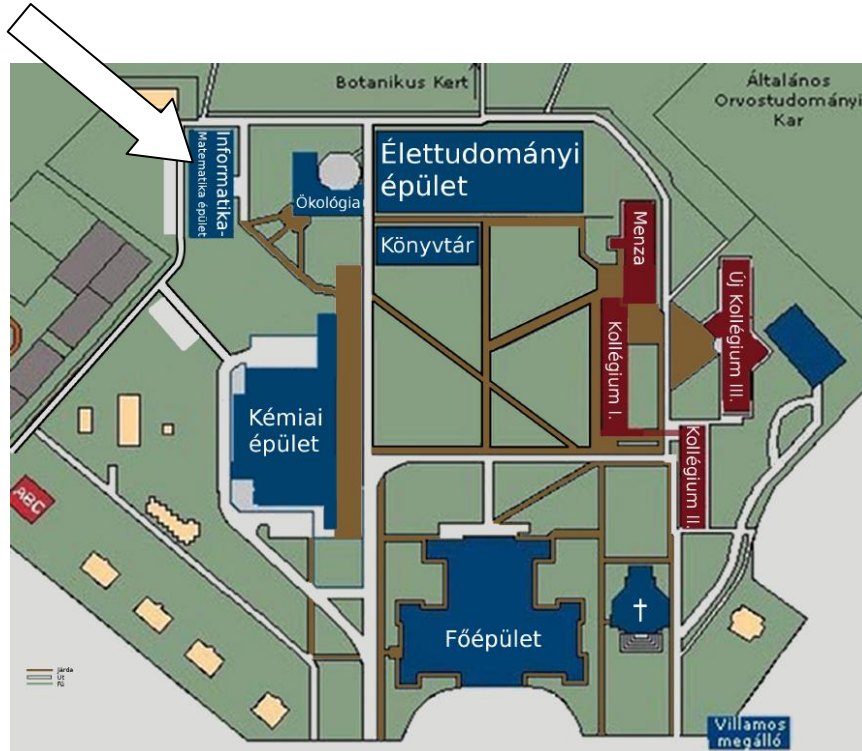
- The details of the subject and the way of its development is determined by the tutor at the first seminar. The phases of the work can be the following: Search for literatures, system analysis, system design, construction, testing, implementation, documentation.
- The written report of the work of the 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:

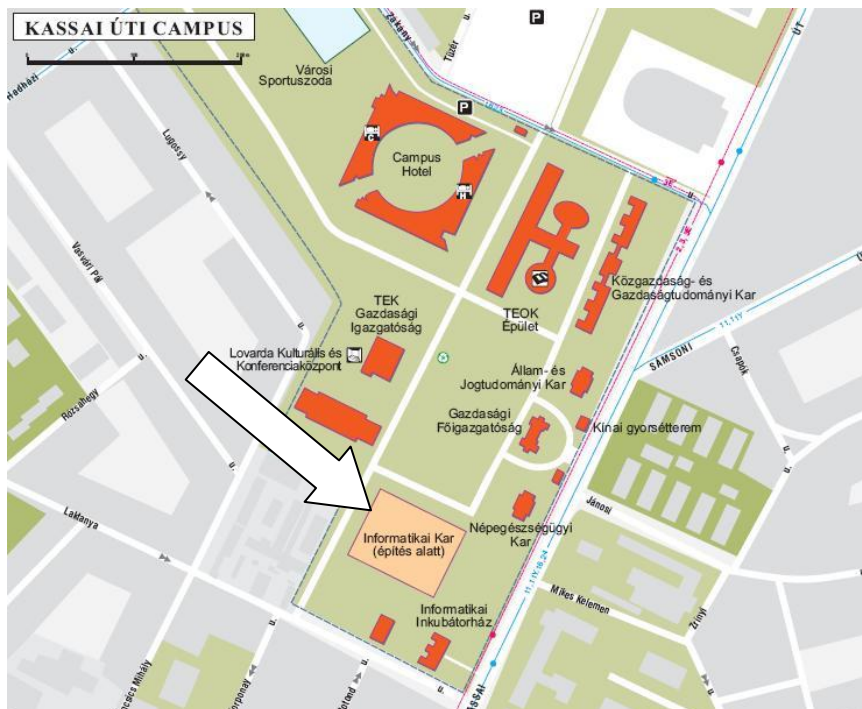
- According to the guidance of the tutor
 - According to the research for literature
-

The map of the campus

The building of Faculty of Informatics



The new building of Faculty of Informatics



Scenery plans of our new buildig at the Campus of Kassai street

