UNIVERSITY OF DEBRECEN

FACULTY OF INFORMATICS

BSc degree courses
MSc degree courses
PhD courses

Research

Business Informatics BSc

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Contents

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 coINJided 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.
SINJerely,

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 INJreasingly 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 INJreased 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 INJlude 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 INJrease the knowledge base and business intelligence of organisations, to model processes based on interaction between info-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 posses 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, INJluding 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 posses 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 INJrease the knowledge base and business intelligence of organisations, to model processes based on interaction between info-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 posses 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, INJluding 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 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 (Batchelor 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, INJluding 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 sINJe 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 INJrease 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

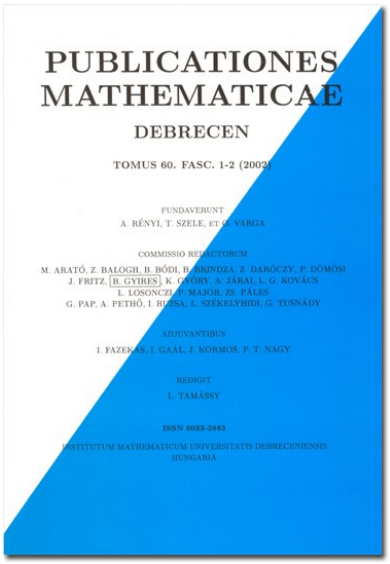
The scientific research conducted at the Faculty of Informatics has steadily broadened in scope and INJreased in depth over the past decades. Our international reputation for excellence has been further strengthened by the work of our leading scientists in the following areas: stochastic processes and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

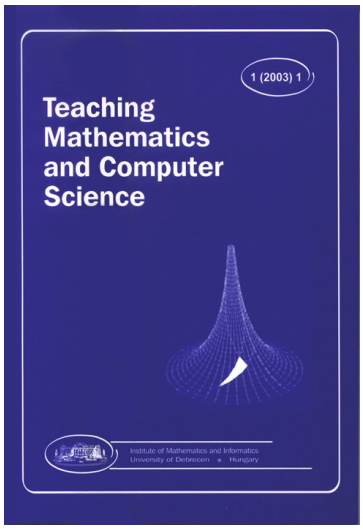


Publicationes Mathematicae Debrecen

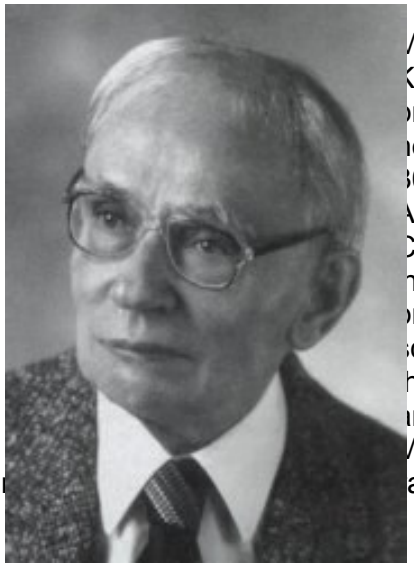
The journal appears quarterly and publishes original research papers on pure mathematical topics. It welcomes contributed papers that develop interesting, or important, new mathematical ideas and results or solve outstanding problems. All papers are refereed for correctness and suitability for publication.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

Teaching Matematics 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 INJorporated 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 ations 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 rendom 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 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://w1.inf.unideb.hu/en/web/komputergrafika-es-kepfeldolgozas-tanszek/home

Research fields

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

Business Informatics BSc Course

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 INJrease the knowledge base and business intelligence of organisations, to model processes based on interaction between info-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 posses the depth of theoretical knowledge necessary to continue their training in the second cycle.

Length of course
Number of semesters: 7.
Total hours (total student study time): the number of teaching (contact) hours: min. 2100.
Number of credits required to obtain degree: 210.

	Credits
Natural science and basic vocational training	139
Subjects compulsory for specialisations	44
Optional vocational subjects of choice	12
Thesis	15

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

- INJK531 Foundation of computer security
- INJK302 Programming languages 2
- INJKA11 Microeconomics
- INJK112 Statistics 2
- INJKM01 Business Economics

Subjects of Natural science and basic vocational training

Code	Subject	Credit	Hrs per week			Exam	Prere-quisites	Period	Semester
			Th.	Practice					
				CR	CL				
INJK101	Mathematics 1	5	2	2		TE, S		1	1
INJK401	Logic in computer science	5	2	2		TE, S		1	1
INJKA01	Introduction to Economics	3	2			TE		1	1
INJKM01	Business Economics	3	2			TE		1	1

INJKM11	Organizational behaviour	4	2	1		TE, S		1	1
INJK701	Computer architectures	3	2			TE		1	1
INJK201	Introduction to informatics	5	2		2	TE, S		1	1
INJK102	Mathematics 2	5	2	2		TE, S	INJK101	2	2
INJKA11	Microeconomics	5	2	2		TE, S	INJKA01	2	2
INJK301	Programming languages 1	5	2		2	TE, S	INJK201	2	2
INJK211	Operating systems 1	5	2		2	TE, S	INJK201	2	2
INJKJ01	Business civil law	3	2			TE		2	2
INJK411	Data structures and algorithms	5	2	2		TE, S	INJK201	2	2
INJK111	Statistics 1	5	2	2		TE, S	INJK102	1	3
INJKP01	Accountancy 1	5	2	2		TE, S		1	3
INJKA21	Macroeconomics	5	2	2		TE, S	INJKA11	1	3
INJKP11	Corporate finance 1	4	2	1		TE, S		1	3
INJKM31	Marketing	4	2	1		TE, S		1	3
INJK212	Operating systems 2	5	2		2	TE, S	INJK211	1	3
INJK302	Programming languages 2	5	2		2	TE, S	INJK301	1	3
INJK112	Statistics 2	5	2		2	TE, S	INJK111	2	4
INJK421	Theory of computing	3	2			TE	INJK401	2	4
INJK121	Numerical mathematics	5	2		2	TE, S	INJK102	2	4
INJK311	Programmming labor 1	6			6	P	INJK302	2	4
INJK431	Introduction to artificial intelligence	5	2	2		TE, S	INJK301 INJK401	2	4
INJKV01	EU studies	3	2			TE		1	5
INJK711	Computer networks (architectures and protocols)	5	2		2	TE, S	INJK701	1	5
INJK312	Programmming labor 2	2			2	P	INJK311	1	5
INJK511	Database systems	5	2		2	TE, S	INJK301 INJK411	1	5
INJS001	Thesis 1	5		6		P		1	5
INJK531	Foundations of computer security	3	2			TE	INJK301 INJK711	2	6
INJK551	Data processing	5	2		2	TE, S	INJK301	2	6
INJS002	Thesis 2	5		6		P		2	6
INJK571	Decision supporting systems	3	2			TE		1	7
INJS003	Thesis 3	5		6		P		1	7

Subjects compulsory for the specializations

Corporate management

Code	Subject	Credit	Hrs per week			Exam	Prere-quisites	Period	Semester
			Th.	Practice					
				CR	CL				
INJVP02	Accountancy 2	5	2	2		TE, S	INJKP01	2	6
INJVP21	Management control system	4	2	1		TE, S	INJKP11	1	5
INJVP31	SAP applications 1	3			2	P	INJKP11	1	5
INJV171	Operations research	5	2		2	TE, S	INJK102	1	7
INJVP12	Corporate finance 2	4	2	1		TE, S	INJKP11	2	6
INJVP41	Financial planning and analysis with PC	3			2	P	INJKP11	1	7
INJVP51	SAS business intelligence	3			2	P	INJK401	1	7
INJVM61	Strategic management	3	2			TE	INJKM01	1	7
INJVP32	SAP applications 2	3			2	P	INJVP31	2	6
INJV141	Financial mathematics	5	2	2		TE, S	INJK112	1	5
INJV151	Statistics with computer	3			2	P	INJK112	1	7
INJV561	Content management	3			2	P	INJK302 INJK711	2	6

e-Business

Code	Subject	Credit	Hrs per week			Exam	Prere-quisites	Period	Semester
			Th.	Practice					
				CR	CL				
INJV331	Web application development	5	2		2	TE, S	INJV561	1	7
INJV561	Content management	3			2	P	INJK302 INJK711	2	6
INJV321	Software development for mobile devices	5	2		2	TE, S	INJK302 INJK711	2	6
INJV341	Technology of development of Internet applications	3			2	P	INJK302 INJK711 INJK511	1	7
INJV131	Information theory	3	2			TE	INJK102	1	6

INJV581	Data security	7	4		2	TE, S	INJV131 INJK531	1	7
INJV181	Coding theory	3	2			TE	INJV131	1	7
INJVM41	Internet-marketing	4	1	2		TE, S	INJKM31	1	5
INJVM71	International marketing	4	1	2		TE, S	INJKM31	1	7
INJVM51	E-management	4	1	2		TE, S	INJKM01	2	6
INJV161	Applications of probability theory	3	2			TE	INJK112	2	6

Subjects optional for the specialisations

Code	Subject	Credit	Hrs per week			Exam	Prere-quisites	Period	Semester
			Th.	Practice					
				CR	CL				
INJFM21	Human resource management	4	2	1		TE, S		2	
INJF501	System engineering	3	2			TE	INJK301	1	
INJF541	Performance evaluation of computer networks	2	2			TE	INJK111	2	
INJF521	Information economics	3	2			TE		1	
INJFV31	Project work	12							
INJFV11	Economy history 1	3	2			TE		1	
INJFV12	Economy history 2	3	2			TE	INJFV11	2	

Subjects optional for the Corporate management specialisation

INJV441	Knowledge based systems	5	2		2	TE, S	INJK431	2	

Subjects optional for the e-Business specialisation

INJV151	Statistics with computer	3			2	P	INJK112	1	

Exam: TE – terminal examination
S – sign
P – practical sign

Subject programs

MATHEMATICS 1
INJK101

Topics:
Elements of set theory and mathematical logic. Real numbers. Sequences, convergence, monotonicity. Infinite series. Limit and continuity of functions. Properties of continuous functions. Differential calculus of functions of one variable. Extremum. Riemann integral of functions of one and two variables.

Compulsory/Recommended Readings:

- Sydsæter, K., Hammond, P.: Mathematics for Economic Analysis, Prentice Hall, 1995.
- Rosser, M.: Basic Mathematics for Economists, Routledge, London, 1993.
- Handouts (theory and problems) by the lecturer

LOGIC IN COMPUTER SCIENCE
INJK401

Topics:
Propositional logic – syntax, semantics. The language of first-order-logic, terms, formulas.
Free variables and bounded variables, bounded variables renaming, quantifier-free formula. Term substitution. Interpretations, truth assignments. Satisfiablility, logically valid formulas and contradictions. Logical equivalences. Conjunctive and disjunctive normal forms, prenex normal forms. Logical consequences. Gentzen sequents, Gentzen calculus, soundness, completeness.

Compulsory/Recommended Readings:

- Mendelson, E.: Introduction to Mathematical Logic, Chapman & Hall, 1997.
- Gabbay, D. M., Abramsky, S., Maibaum, T. S. E.: Handbook of Logic in Computer Science, Oxford University Press, 2000.

INTRODUCTION TO ECONOMICS
INJKA01

Topics:
The subject, method and the short history of Economics; the concept of economic agents; national INJome; the market mechanisms: the analysis of demand and supply; comparative static analysis; the concept of the product-, money- and labor market; the instruments of economic policy: fiscal and monetary policy; the role of the Central Bank; development of banks and the financial system; the functions of financial intermediary; the process of money creation; current issues of the Hungarian economy.

Compulsory/Recommended Readings:

- Heyne, P., Boettke, P., Prychitko, D.: The Economic Way of Thinking, Prentice Hall, 10th edition, 2002.
- Samuelson, P. A., Nordhaus, W. D.: Economics, McGraw-Hill, 17th edition, 2001. Buchholz, T. G.: New Ideas from Dead Economists, New York: Penguin Group, 1989. Buchholz, T. G.: From Here to Economy: A Shortcut to Economic Literacy, Plume, 1996.

BUSINESS ECONOMICS
INJKM01

Topics:
The domestic economic environment – The international economic environment – The structure of the economy – Organization of firms and markets – Business objectives – Demand, costs, pricing and investment in theory and practice – Government and business.

Compulsory/Recommended Readings:

- Hornby, W., Gammine, R., Wall, S.: Business Economics, FT Prentice Hall, London, New York, 2001.
- Begg, D., Ward, D.: Economics for Business, The McGraw-Hill Companies, London, Boston, 2003.
- Mulhearn, C., Vane, H. R., Eden, J.: Economics for Business, Palgrave, New York, 2001.

ORGANIZATIONAL BEHAVIOUR
INJKM11

Topics:
The field of Organizational Behaviour, the definition of organizations, foundations of individual behaviour: ability, personality, attitudes, job satisfaction, learning, perception, decision making, motivation, emotions and moods; foundations of group behaviour: roles, norms, status, size, cohesiveness, group decision making, understanding teams, creating effective teams, communication, leadership, power and politics, conflict and negotiation; foundations of organization structures: common organization design, new structural options, organizational culture, organizational change and development.

Compulsory/Recommended Readings:

- Robbins, S. P., Judge, T. A.: Essentials of Organizational Behavior, Person Prentice Hall, 9th edition, 2007.
- Janasz, S. C., Down, K. O., Schneider, B. Z.: Interpersonal Skills in Organizations, McGraw Hill, New York, 2002.
- Marcic, D., Seltzer, J.: Organizational Behavior, Experiences and Cases, South- Western College Publishing Company, 5th edition, 1998.

COMPUTER ARCHITECTURES
INJK701

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, entcoder, 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 prINJiples. 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 Kaufmannn Publ., 2nd edition, 1998.
- Williams, R.: Computer System Architecture (A Networking Approach), Addison Wesley, 2001.

INTRODUCTION TO INFORMATICS
INJK201

Topics:
Computer as information processing machine. Computer architectures. Basic terminology of informatics (data, program, programming, operating system, software, system software, application software, bit, byte, spreadsheet programs, text editors, database management systems). Types and use of peripheral devices. Concept of operating systems. Algorithms. Scales, convension of conversion. Computer information representation (address, logical, string and numerical data, operations and programs). Basics of computer processors. Programming computers. Programming in Machine code. Network basics. Steps of information system development.

Compulsory/Recommended Readings:

- Brookshear, J. G.: Computer Science: An Overview, Addison Wesley, 7th edition, 2003.
- Snyder, L.: Fluency with Information Technology: Skills, Concepts and Capabilities, Addison Wesley, 2004.

MATHEMATICS 2
INJK102

Topics:
The vector space R^n. Matrix calculus. Determinants. Linear systems of equations. Vector spaces, linear transformations, matrix representation. Euclidean spaces. Differential calculus of functions of several variables. Extrema, constrained extrema.

Events, probability space. Combinatorial methods of calculating probabilities. Conditional probabilities, independence. Bayes theorem. Discrete random variables, expectation, variance. Bernoulli, discrete uniform, binomial, hipergeometric, negative binomial and Poisson distributions. Distribution function, density, expectation and variance of continuous distributions. Uniform, exponential, Cauchy and normal distributions. Joint distribution andindependence of random variables. Correlation, moments, skewness, curtosis, modus, median, quantiles, covariance matrix.

Compulsory/Recommended Readings:

- Sydsæter, K., Hammond, P.: Mathematics for Economic Analysis, Prentice Hall, 1995.
- Feller, W.: An introduction to probability theory and its applications, Vol. I., John Wiley & Sons INJ., New York-London-Sydney, 3rd edition, 1968.
- Shiryaev, A. N.: Probability, Translated from the first Russian edition (1980) by R. P. Boas, Graduate Texts in Mathematics 95., Springer-Verlag, New York, 2nd edition, 1996.
- Handouts (theory and problems) by the lecturer.

MICROECONOMICS
INJKA11

Topics:
The subject and method of Microeconomics; the theory of consumer's choice; market equilibrium and efficiency; technological constraints; profit-maximizing behaviour; cost curves; supply in a competitive market; monopoly and monopolistic behaviour; general equilibrium theory and welfare; externalities; public goods.

Compulsory/Recommended Readings:

- Samuelson, P. A., Nordhaus, W. D.: Economics, McGraw-Hill Companies, 16th edition, 1998. (Microeconomics chapters)
- Mankiw, G.: PrINJiples of Microeconomics and Study Guide, South-Western College Pub, 4th edition, 2006.
- Besanko, D., Braeutigam, R. R.: Microeconomics and Study Guide, John Wiley & Sons, 2nd edition, 2004.
- Taylor, J. B.: PrINJiples of Microeconomics, Boston, New York: Houghton Mifflin, 1998.

PROGRAMMING LANGUAGES 1
INJK301

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:

- Sebesta, R. W.: Concepts of Programming Languages, Addison-Wesley, 2006.
- Scott, M. L.: Programming Language Pragmatics, Morgan Kaufmann, 2000.

OPERATING SYSTEMS 1
INJK211

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 peripheries, 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 (Windows, Unix/Linux/Solaris).

Compulsory/Recommended Readings:

- Silberschatz, A., Galvin, P. B., Gagne, G.: Operating system concepts, Wiley, 8th edition, 2008.
- Nutt, G. J.: Operating systems, Addison-Wesley, 3rd edition, 2003.
- Stallings, W.: Operating systems (Internals and design prINJiples), Prentice Hall, 4th edition, 2001.

BUSINESS CIVIL LAW
INJKJ01

Topics:
Property law. General rules of contracts. Individual contracts. Law relating to stocks and shares. The guarantee of collateral obligations in contracts. Breach of contract. Compensation law. Non-profit organisations. Sole traders. Partnerships. Limited companies. Companies with limited liability. Public limited companies. Bankruptcy and liquidation procedures.

Compulsory/Recommended Readings:

- Barton, J. H.: International Business and Civil Law, University of California – Stanford University, 1997.
- Lecture notes prepared by the instructor
- Kelly, D., Holmes, A. E. M., Hayward, R.: Business Law, Routledge Cavendisch,2005.
- Mallor, J. P., Bowers, Th., Langvardt, A. W., Barnes, J.: Business Law: The Ethical, Global and E-Commerce, McGraw-Hill Education Europe, 2006.

DATA STRUCTURES AND ALGORITHMS
INJK411

Topics:
Concept and classification of data structures. Operations on data structures (create, add, delete, change, search, traverse, process). Representation, implementation and usage of data structures. Abstract data structures. Set, multi-set, array, associative array, list, stack, queue, tree, graph, graph algebra, record. File operations (create, modify, process, reorganize, sort). File structures (simple and complex), linking, indexing. Serial, sequential, direct, random, indexed, inverted, multi-list.

Compulsory/Recommended Readings:

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

STATISTICS 1
INJK111

Topics:
Important distributions in statistics: chi-square, Student, F-distributions. Multidimensional normal distribution. Cauchy-Schwarz, Markov and Chebyshev inequalities. Laws of large numbers (Bernoulli, weak, strong). Central limit theorems.
Basic concepts of statistics; descriptive statistics: analysis of quantitative variables; stochastic relationships, graphical methods; standardisation for the decomposition of differences and ratios, value, price, and quantity indices; sampling; estimation theory, point and interval estimation, the basics of hypothesis testing, fundamental parametric tests (Z, t, and F tests), applications and case studies using SPSS.

Compulsory/Recommended Readings:

- Bain, L. J., Engelhardt, M.: Introduction to probability and mathematical statistics, Duxbury, 2nd edition, 1992.
- Anderson, D. R. et al: Statistics for Business and Economics, South-Western Educational Publishing, 2001.
- Feller, W.: An introduction to probability theory and its applications, Vol. I., John Wiley & Sons INJ., New York-London-Sydney, 3rd edition, 1968.
- Shiryaev, A. N.: Probability, Translated from the first Russian edition (1980) by R. P. Boas, Graduate Texts in Mathematics 95., Springer-Verlag, New York, 2nd edition, 1996.
- Handouts, lecture notes
- Rice, J. A.: Mathematical Statistics and Data Analysis, Duxbury Press, 2nd edition, 1994.
- Afriat, S. N: The Price Index and its Extension: A Chapter in Economic Measurement, Routledge, 2004.
- SPSS Manual Books

- Zagumny, M. J.: The Spss Book: A Student Guide to the Statistical Package for the Social Sciences, Writers Club Press, 2001.

ACCOUNTANCY 1
INJKP01

Topics:
Concept of accountancy. Property of the entrepreneur, statement of property. Economic transactions and their impacts on property. Definition of result, its classification and statement. Fundamental conceptions of bookkeeping. Phases of accounting work (documents). Phases of accounting work (registering, analytic and synthetic registering, analytic and synthetic registering settlement of accounts). Phases of accounting work (closing items, aggregate summaries). Summing up example for presenting the connection between the bookkeeping accounts, profit and loss statement and balance sheet. Reporting and bookkeeping obligation. Accounting services. Regulation of entreprises' accountancy. Accounting system. Accounting act. Basic accounting prINJiples, accounting policy. Generally about bookkeeping and reporting. Structure and characteristics of balance sheet. Valuation of balance sheet items.

Compulsory/Recommended Readings:

- Horngren, C. T., Sundem, G. L., Elliott, J. A., Philbrick, D.: Introduction to Financial Accounting (Charles T. Horngren Series in Accounting), Prentice Hall INJ., 9th edition, 2005.
- Hirst, D. E., McAnally, M. L.: Cases in Financial Reporting, Prentice Hall INJ., 5th edition, 2005.
- Horngren, C. T., Harrison, W. T.: Accounting Textbook Accounting (MyAccountingLab Series), Prentice Hall INJ., 7th edition, 2006.
- Lecture notes for the students

MACROECONOMICS
INJKA21

Topics:
Production and distribution of national INJome; functions of money; the quantity theory of money; seigniorage; theories of money demand, money supply and the financial system; labour market and unemployment; macroeconomic consumption; investment; commodity market and the IS curve; the multiplier effect; aggregate demand; money market and the LM curve; inflation and the Phillips curve; fiscal and monetary policy in the IS-LM model; aggregate supply; business cycles; macroeconomic debate on economic policy; economic growth.

Compulsory/Recommended Readings:

- Mankiw, N. G.: Macroeconomics, Worth Publishers, New York, 2007.
  Hall, R., Taylor, J. B., Papell, D.: Macroeconomics, W. W. Norton & Co Ltd, New York, 2005.

CORPORATE FINANCE 1
INJKP11

Topics:
Axioms of corporate finance. Goals of financial management. Financial statements and corporate finance. Cash-flow statement. Break-even analysis. Analysis of financial statements: likvidity ratios, long term solvency ratios, turnover measures, profitability and market value measures. Risk and returns. Financial and operational leverage. Time value of money: present value, future value, annuity, perpetuity. Long term and short term business financing. Debt, leasing, bill and factoring. General topics of short term financial management. Operational and financial cycles. Net working capital management. Cash and receivables management. Investment decisions and analysis. Financial planning. Estimation of supplementary capital needs and the business growth.

Compulsory/Recommended Readings:

- Ross, S. A., Westerfield, R. W., Jordan, B. D.: Essentials of Corporate Finance, Mcgraw-Hill/Irwin, 2007.
- Block, B. S., Hirt, G. A.: Foundations of Financial Management, Mcgraw-Hill/Irwin, 2001.
- Brealey, R. A., Myers, S. C., Allen, F.: PrINJiples of Corporate Finance, McGraw- Hill/Irwin, 2005.
- Brigham, E. F., Ehrhardt, M. C.: Financial Management, Theory and Practice, Harcourt College Publishers, 2002.

MARKETING
INJKM31

Topics:
Marketing, the marketing concept, marketing orientation, marketing-mix, segmentation, targeting, positioning, consumer behaviour, institutional buying behaviour, product policy, pricing, distribution, promotion, the marketing information system, marketing strategy, international marketing.

Compulsory/Recommended Readings:

- Armstrong, G., Kotler, P.: Marketing, Prentice Hall, 8th edition, 2007. (selected chapters)
- Solomon, M., Marshall, G., Stuart, E.: Marketing: Real People, Real Choices, Prentice Hall, 5th edition, 2007.
- Hiebing, R. G., Cooper, S. W.: The Successful Marketing Plan: A Disciplined and Comprehensive Approach, McGraw–Hill, 3rd edition, 2003.
- Alsem, K. J.: Strategic Marketing: An Applied Approach, McGraw–Hill, 2007. Ries, A., Trout, J.: Positioning: The Battle for Your Mind, McGraw-Hill, 2001.

OPERATING SYSTEMS 2
INJK212

Topics:
Practical implementations of operating systems. Comparisons of types and platforms.
Distributed systems. Comprehensive study of some sophisticated OS components.

Compulsory/Recommended Readings:

- Silberschatz, A., Galvin, P. B., Gagne, G.: Operating system concepts, Wiley, 8th edition, 2008.
- Nutt, G. J.: Operating systems, Addison-Wesley, 3rd edition, 2003.
- Stallings, W.: Operating systems (Internals and design prINJiples), Prentice Hall, 4th edition, 2001.

PROGRAMMING LANGUAGES 2
INJK302

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. The functional paradigm. First-class function values and higher-order functions, recursion, structured functions. Economical and statistical programming languages (VBA, SPSS, SAP, R programming). Other languages.

Compulsory/Recommended Readings:

- Sebesta, R. W.: Concepts of Programming Languages, Addison-Wesley, 2006.
- Scott, M. L.: Programming Language Pragmatics, Morgan Kaufmann, 2000.

STATISTICS 2
INJK112

Topics:
The most important parametric and non-parametric statistical tests (Z, t, F, chi-squares, Analysis of Variance, binomial, rank and run tests, Kolmogorov-Smirnov tests, etc.); deterministic and stochastic time-series analysis, bi- and multivariate regression analysis, correlation analysis, applications and case studies using SPSS.

Compulsory/Recommended Readings:

- Bain, L. J., Engelhardt, M.: Introduction to probability and mathematical statistics, Duxbury, 2nd edition, 1992.
- Anderson, D. R. et al: Statistics for Business and Economics, South-Western Educational Publishing, 2001.
- Handouts, lecture notes
- Rice, J. A.: Mathematical Statistics and Data Analysis, Duxbury Press, 2nd edition,1994
- Afriat, S. N.: The Price Index and its Extension: A Chapter in Economic Measurement, Routledge, 2004
- SPSS Manual Books
- Zagumny, M. J.: The Spss Book: A Student Guide to the Statistical Package for the Social Sciences, Writers Club Press, 2001.

THEORY OF COMPUTING
INJK421

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:

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

NUMERICAL MATHEMATICS
INJK121

Topics:
Floating point arithmetic. Norms, condition numbers, error estimations. Solutions of linear equations: Gaussian-elimination, LU decomposition, Cholesky decomposition. Least squares approximation. Eigenvalue problems: localization of eigenvalues, power method, inverse interpolation. Interpolation: Lagrangian interpolation, Newton recursion, Hermite interpolation. Nonlinear equations: fixpont iteration, bisection-, chord-, secant- and Newton method. Systems of nonlinear equations: Newton and Gauss-Newton method. Numerical integration: numerical quadratures, Newton-Cotes formulae, multiple integrals. Applications of the MATLAB numerical package.

Compulsory/Recommended Readings:

Atkinson, K. E.: Elementary Numerical Analysis, John Wiley, New York, 1993. Lange, K.: Numerical analysis for statisticians, Springer, New York, 1999.
Press, W. H., Flannery, B. P., Tenkolsky, S. A., Vetterling, W. T.: Numerical recipes in C, Cambridge University Press, Cambridge, 1988.

PROGRAMMING LABOR 1
INJK311

Topics:
Translators and interpreters. Implementations of programming languages. Integrated development environments. A source code generation, programming language oriented texteditors. Compilation controlling. Maps usage. Program running, termination and debugging. Main properties of procedure-oriented, object-oriented, functional and logical development environments. Web-aided development environments. CASE-tools.

Compulsory/Recommended Readings:

Stevens, W. R.: Advanced programming in the UNIX environment, Addison Wesley, 1993.

- Petzold, C.: Programming Windows, Microsoft Press, 1998.

INTRODUCTION TO ARTIFICIAL INTELLIGENCE
INJK431

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, variants of A algorithm, monotone restriction. Problem-reduction representation and AND/OR graphs. Search procedures for AND/OR graphs, AO algorithm. Two-person, perfect-information games, game trees, winning strategy. Mini-max procedure, alpha-beta pruning procedure.

Compulsory/Recommended Readings:

- Nilsson, N.: Artificial Intelligence, A New Synthesis, The Morgan Kaufmann Series in Artificial Intelligence, 1998.
- Russel, S. J., Norvig, P.: Artificial Intelligence, A Modern Approach, Prentice- Hall, 1995.

EU STUDIES
INJKV01

Topics:
Integration theory and forms of integration; the history of the European integration; the structure and institutions of the EU; decision-making procedures; the law of the EU; the common market, the common policies of the EU; the EU budget; the monetary union and the euro.

Compulsory/Recommended Readings:

- Moussis, N.: Access to European Union, European Study Servis, Rexinsart, 2006.
  Horváth, Z.: Handbook of the European Union, HVG ORAC Lap és Könyvkiadó Kft. 2005.
- Wallace, H., Wallace, W., Pollack, M. A.: Policy-making in the European Union, Oxford University Press, 2005.
- Csaba, L.: The New Political Economy of Emerging Europe, Akadémiai Kiadó, Budapest, 2007.

COMPUTER NETWORKS (ARCHITECTURES AND PROTOCOLS)
INJK711

Topics:
Basic concepts of networking architectures. The ISO/OSI and TCP/IP reference models. Physical layer standards. Channel access methods and implementations: ALOHA protocols, CSMA, collision-free, limited-contention free. The IEEE 802.3 standard and the ETHERNET. Network layer protocols, IP addressing. The routing algorithms of the network layer (shortest path, centralized - distributed, hierarchical). Transport layer protocols and implementations. Application layer protocols (e.g. DNS, SMTP, HTTP).

Compulsory/Recommended Readings:

- Tanenbaum, A. S.: Computer Networks, Prentice-Hall, 4th edition, 2003.
- Stallings, W.: Data and Computer Communications, Prentice-Hall, 7th edition, 2003. Bates, R. J., Gregory, D. W.: Voice and Data Communications Handbook, McGraw- Hill, 4th edition, 2001.
- RFC Documents: http://www.rfc-editor.org/

PROGRAMMING LABOR 2
INJK312

Topics:
Exceptions and their handling. Modular, structured and object-oriented programming methodology. Formal program development. Reuse-oriented programming. Role of abstractions. Samples of program codes. Components. Expressiveness of programming languages. The „good‖ style of programming. Debugging and verification. Software metrics. Quality assurance of software.

Compulsory/Recommended Readings:

- Sommerville, I.: Software Engineering, Pearson Education, 2004.
- Galin, D.: Software Quality Assurance: From Theory to Implementation, Addison Wesley, 2004.

DATABASE SYSTEMS
INJK511

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.
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, object oriented concepts, ODMG
Object Model. Study of a concrete DBMS

Compulsory/Recommended Readings:

- Elmasri, R., Navathe, S. B.: Fundamentals of Database Systems, Addison Wesley, 2004.
- Ullman, J. F., Widom, J.: A First Course in Database Systems, Prentice Hall, 1997.

FOUNDATIONS OF COMPUTER SECURITY
INJK531

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 (risc analysis, risc 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, J., Hardjono, T., Seberry, J.: Fundamentals of Computer Security, Springer, 2010.

DATA PROCESSING
INJK551

Topics:
Database programming: linkage to relational database systems through Java programming
language. Low level database handling in applications J2SE and J2EE, JDBC procedure. Usage of name and library services in Java: JNDI interface for programmers. The technology XML. XML name spaces and specifications. High level data processing with Java. Object- Relational Mapping. Persistent storage of Java Objects in relational databases. Persistent realization in architecture Java Data Objects (JDO). XML databases.

Compulsory/Recommended Readings:

- Lecture notes for the students.
- Bradley, N.: The XML schema, Addison-Wesley Professional, 2003.
- Fisher, M., Ellis, J., Bruce, J.: JDBC API Tutorial and Reference, Reading/Ma., Addison-Wesley Professional, 3rd edition, 2001.
- Lee, R., Seligman, S.: JNDI API Tutorial and Reference: Building Directory-Enabled Java(TM) Applications, Reading/Ma., Addison-Wesley Professional, 2000.

DECISION SUPPORTING SYSTEMS
INJK311

Topics:
Overview of different types of decision making: strategic, tactical and operational. Decision-making normative rules. General prINJipals of decision-making. Decision analysis and decision making. Programmable and not programmable decisions. Uncertain decision and risky decisions. Grouping criteria. Risk and uncertanity quantifying. Decision-making procedures. Decision-making under uncertainty. Decision-making under risk. Decision matrix. Decision tree. Conception decision utility and determination. Group decision-making. Strategies of group decision-making. Methods of group decision-making. Operations research modeling systems and simulation.

Compulsory/Recommended Readings:

- Kleindorfer, P. R., Kunreuther, H. C., Schoemaker, P. J. H.: Decision Sciences: an integration perspective, Cambridge University Press, 1993.
- Marakas, G. M.: Decision Support Systems in the 21st Century, Prentice Hall, 1999.
- Turban, E., Aronson, J. E.: Decision Support Systems and Intelligent Systems, Prentice Hall, 6th edition 2001.
- Gray, P., Watson, H. J.: Decision Support in the Data Warehouse, Upper Saddle River, NJ; Prentice-Hall PTR, 1998.
- Heymann, H. G., Bloom, R.: Decision Support Systems in Finance and Accounting, New York : Quorum Books, 1988.
- Lotfi, V., Pegels, C.: Decision Support Systems for Operations Management and Management Science, Homewood, IL: Irwin, 3rd edition, 1996.
- McNichols, C. W., Clark, T. D.: Microcomputer-Based Information and Decision Support Systems for Small Businesses: A Guide to Design and Implementation, Reston, VA: Reston Publishing (A Division of Prentice-Hall), 1983.
- Sauter, V. L.: Decision Support Systems: An Applied Managerial Approach, New York: John Wiley & Sons, 1997.

Corporate management (specialisation)

ACCOUNTANCY 2
INJVP02

Topics:

Definition, classification and valuation of fixed assets, intangible assets and tangible assets.

Depreciation's definition, measurement and settlement of accounts. Documents, registering and the applied ledger accounts for intangible assets and tangible assets. Accounting of intangible assets and tangible assets. Accounting of financial investments and securities. Definition, classification and valuation of inventories. Accounting of stocks purchased. Accounting of self-produced stocks, and animals for breeding and fattening and other livestock. Definition, classification, valuation and accounting of receivables. Definition, classification and accounting of liquid assets. Definition, classification of deferred charges and accrued INJome. Accounting of accrued and deferred assets. Accounting of accrued and deferred liabilities. Definition, classification of equity and liabilities. Accounting of Equity. Definition, classification and accounting of provisions. Definition, classification and accounting of liabilities.

Compulsory/Recommended Readings:

- Lecture notes provided by the instructor.
- Horngren, C. T., Sundem, G. L., Elliott, J. A., Philbrick, D.: Introduction to Financial Accounting (Charles T. Horngren Series in Accounting), Prentice Hall, 9th edition,2005.

- Hirst, D. E., McAnally, M. L.: Cases in Financial Reporting, Prentice Hall, 5th edition, 2005.
- Horngren, C. T. Harrison, W. T.: Accounting Textbook Accounting (MyAccountingLab Series), Prentice Hall INJ., 7th edition, 2006.

MANAGEMENT CONTROL SYSTEM
INJVP21

Topics:
System thinking. What is the controlling? Controller functions. Corporate controlling organizations. Designing and functioning of a corporate controlling system. Communication and controlling. Strategical, tactical and operational business planning. Cost management. Traditional cost management. Activity based cost management. Activity based management. Transfer pricing. Strategical and operational performance measurement. Corporate evaluation (DCF, ROI, CFROI, EVA, MVA, etc.). Balanced Score Card. Skandia Navigator. Evaluation and decision making development. INJentive methods. Computer support in controlling.

Compulsory/Recommended Readings:

- Anthony, R. N., Govindarajan, V., Anthony, R.: Management Control Systems, Richard D. Irwin INJ., 2007.
- Flamholtz, E. G.: Effective Management Control, Kluwer Academic Publishers, 1996.
- Merchant, K., Van der Stede, W.: Management Control Systems, Performance Measurement, Evaluation and INJentives, Prentice Hall, 2007
- Additional readings will be distributed or made available online throughout the course.

SAP APPLICATIONS 1
INJVP31

Topics:
Description of the features of Enterprise Resource Planning Systems (2 classes), review of the SAP AG's brief history and the specialities of its R/3 system (2 classes). Providing application skills of SAP R/3 system (20 classes). This INJludes the demonstration of functions available in the basic SAP window, system navigation, data input possibilities, reporting using standard reports, setting background data processing, report printing, creating report variants, basics of general ledger accounting, simpler cases of customer and vendor invoice and payment recording.

Compulsory/Recommended Readings:

- Schicht, G., Schmieden, A.: Flying Start with SAP R/3, Addison-Wesley-Longman
  Verlag GmbH, Germany, 1999.
- Notes made on the lectures and articles handed out

OPERATIONS RESEARCH
INJV171

Topics:
The role of the operations research in decision making. Classification of problems of
operations research. Theoretical background of linear programming: theory of convex polyhedrons. Basic problem and its solution in linear programming: simplex method, finding initial basic: two-phase simplex method. Avoiding cyclisation: lexicographical simplex method. Versions of the simplex method. Duality. Applications: transportation problem. Discrete programming. Enumeration. Branch and bound.

Compulsory/Recommended Readings:

- Schrijver, A.: Theory of linear and integer programming, A Wiley-Interscience
  Publication, John Wiley & Sons Ltd., Chichester, 1998.
- Roos, C., Terlaky, T., Vial, J.-Ph.: Theory and Algorithms for Linear Optimization, An Interior Point Approach, John Wiley & Sons Ltd., Chichester, 1997.
- Magaril-Il'yaev, G. G., Tikhomirov, V. M.: Convex Analysis: Theory and Application, AMS, 2003.
- Vanderbei, R. J.: Linear programming: Foundations and extensions, International Series in Operations Research and Management Science 37., Kluwer Academic Publishers, Boston, MA, 2nd edition, 2001.

CORPORATE FINANCE 2
INJVP12

Topics:
Long term financing of enterprises. Shareholder equity and debt financing. Long term debt
and leasing. Securities: bonds and stocks, and their valuation. Government securities, investment funds, ware receipts. Diversification and portfolio risk. Risk and risk aversion. Utility. The prINJiple and effects of diversification. Systematic risk and beta. The security market line. Efficient portfolios. Cost of capital. Money and capital markets. The stock exchange. Derivatives (forward, futures, options and swaps) and the risk management.

Compulsory/Recommended Readings:

- Ross, S. A., Westerfield, R. W., Jordan, B. D.: Essentials of Corporate Finance, Mcgraw-Hill/Irwin, 2007.
- Block, B. S., Hirt, G. A.: Foundations of Financial Management, Mcgraw-Hill/Irwin, 2001.
- Brealey, R. A., Myers, S. C., Allen, F.: PrINJiples of Corporate Finance, McGraw- Hill/Irwin, 2005.
- Brigham, E. F., Ehrhardt, M. C.: Financial Management, Theory and Practice, Harcourt College Publishers, 2002.

FINANCIAL PLANNING AND ANALYSIS WITH PC
INJVP41

Topics:

Evolution of information technology nowadays, appearance of artifical intelligence research
in IT, business intelligence (e-business), financial functions of MS Excel spreadsheet and their possibilities for use in practice, general features of financial functions, demonstration of the Excel Solver's application, features and opportunities for practical use of ENCORE financial modelling program in financial analysis and planning, OLAP systems and their importance in analysis and planning. Data Mining, SAS system's opportunities for use as a business intelligence system.

Compulsory/Recommended Readings:

- Articles and slides presented and dissected on the lessons.

SAS BUSINESS INTELIGENCE
INJVP51

Topics:
Basic concepts of SAS System: set-up, modules, SAS dataset, language. Statistical analysis in the Enterprise Miner. Descriptive statistics and graphical analysis. Querying in SAS. Contingency table and regression. Elements of data mining. Supervised and unsupervised learning.

Compulsory/Recommended Readings:

- SAS OnlineDoc 9.1.3 for the Web
- Enterprise Miner 4.3 Reference Help

STRATEGIC MANAGEMENT
INJVM61

Topics:
Introducing strategy – The strategic position: the environment, strategic capability, expectation and proses – Strategic choices: functional-level strategy – business-level strategy – corporate-level and international strategy – Strategy into action: organising for success, managing strategic change – How strategy develops: understanding strategy development, strategy development in organizations.

Compulsory/Recommended Readings:

- Johnson, G., Scholes, K., Whittington, R.: Exploring Corporate Strategy, FT Prentice Hall, London, New York, 2006.
- Thompson, A., Strickland, A. J.: Strategic management, BPI Irwin, Boston, 2002. Luffman, G., Sanderson, S., Lea, E., Kenny, B.: Business policy, Basil Blockwell, Oxford, 2003.

SAP APPLICATIONS 2
INJVP32

Topics:
On the lessons one can get insight into posting and reporting in SAP system the standard transactions occurring in a company: posting and paying INJoming

vendor invoices, posting invoice in Materials Management, down payment to the vendor, automatic payment processing, posting VAT, dunning customers with arrears, purchasing, activating, depreciating fix assets, posting lease fees. One can get detailed insight into the periodic activities for accounts payables, accounts receivables and general ledger, which are connected to the closure of posting periods and business year. At the end of the course one can get overview about the analysis of the balance sheet items.

Compulsory/Recommended Readings:

- Brinkmann, S., Zeilinger, A.: SAP R/3 Financial Accounting, Addison Wesley, 2001. Transactions presented and used on the lessons.

FINANCIAL MATHEMATICS
INJV141

Topics:
Option contracts (call, put, European, American), fair price, bounds for the prices, factors affecting option prices, early exercise, put-call parity. Discrete time markets, binary and binomial markets, strategies, self-financing, arbitrage-free and complete markets, fundamental theorems of asset pricing and formulas for fair price in discrete time models.
Basics of continuous-time markets: Black-Scholes model and numerical procedures, Greeks, hedging strategies. Basics of risk measures, Value at Risk. On seminars problems solved by the help of some software environment which provides the appropriate financial mathematics tools (e.g. the R language and environment).

Compulsory/Recommended Readings:

- Hull, J. C.: Options, Futures and Other Derivatives, Pearson/Prentice Hall, 7th edition, 2008.
- Gáll, J., Pap, G., van Zuijlen, M. C. A.: An introduction to portfolio management, lecture note, mobiDIÁK Oktatási Portál, 2003. (http://iam035.inf.unideb.hu/mobidiak/main.mobi)
- Gáll, J., Pap, G., van Zuijlen, M. C. A.: Option theory, lecture note, mobiDIÁK Oktatási Portál, 2003. (http://iam035.inf.unideb.hu/mobidiak/main.mobi)
- An Introduction to R, http://www.r-project.org/
- Baxter, M., Rennie, A.: Financial Calculus : An Introduction to Derivative Pricing, Cambridge University Press, Cambridge, 1996.
- Huang, Chi-fu, Litzenberg, R. H.: Foundations for financial economics, Prentice Hall, 1988.

STATISTICS WITH COMPUTER
INJV151

Topics:
Basic data analysis: descriptive statistics and graphics. Hypothesis testing. Analysis of variance: one-way and two-way models. Regression analysis. General linear model, OLS estimator. Contingency table, log-linear models. The R language.

Compulsory/Recommended Readings:

- SAS OnlineDoc 9.1.3 for the Web
- Everitt, B. S., Hothorn, T.: A handbook of statistical analysis using R. Chapman & Hall, 2006.

CONTENT MANAGEMENT
INJV561

Topics:
Digital content and document formats. Publishing content on the web. XML technology. The
core XML standards: the XML 1.0 and the Namespaces in XML 1.0 recommendations. Standard XML formats for web publishing: XHTML, MathML (describing mathematical formulae), SVG (describing 2D vector graphics), XForms (web forms). Cascading Style Sheets (CSS). Styling XML and XHTML documents using CSS stylesheets. Multimedia content: Synchronized Multimedia Integration Language (SMIL).
XSLT: transforming XML documents with XSLT stylesheets. XML-based content publishing for multiple different client devices. Non-traditional client devices. Voice browsers: voice- based content and interaction using speech synthesis and speech recognition, the VoiceXML standard. Device independence.

Compulsory/Recommended Readings:

- Bradley, N.: The XML Companion, Addison-Wesley, 3rd edition, 2001.
- Meyer, E.: CSS: The Definitive Guide, O'Reilly, 3rd edition, 2006.
- Harold, E. R., Means, W. S.: XML in a Nutshell, O'Reilly, 3rd edition, 2004. Mangano, S.: XSLT Cookbook, O'Reilly, 2nd edition, 2005.
- Musciano, C., Kennedy, B.: HTML & XHTML: The Definitive Guide, O'Reilly, 6th edition, 2006.
- Tennison, J.: Beginning XSLT, Apress, 2004.
- Bulterman, D. C. A., Rutledge, L.: SMIL 2.0: Interactive Multimedia for Web and Mobile Devices, Springer, 2004.

e-Business (specialisation)

WEB APPLICATION DEVELOPMENT
INJV331

Topics:
Web services: concepts and architecture. XML-based information exchange in decentralized, distributed environments. Web Services Description Language: describing Web services. Registering and discovering Web services. Using Web services. Secure Web services. Describing policies related to Web services. RESTful web services. Service Oriented Architecture (SOA). Developing Web services with Java.

Compulsory/Recommended Readings:

- Alonso, G., Casati, F., Kuno, H., Machiraju, V.: Web Services: Concepts, Architectures and Applications, Springer, 2003.
- Newcomer, E., Lomow, G.: Understanding SOA with Web Services, Addison-Wesley Professional, 2004.
- Erl, T.:Service-Oriented Architecture: A Field Guide to Integrating XML and Web Services, Prentice Hall, 2004.
- Zimmermann, O., Tomlinson, M. R., Peuser, S.: Perspectives on Web Services: Applying SOAP, WSDL and UDDI to Real-World Projects, Springer, 2nd edition, 2005.
- Richardson, L., Ruby, S., Heinemeier Hansson, D.: RESTful Web Services, O'Reilly, 2007.
- Rosenberg, J., Remy, D.: Securing Web Services with WS-Security: Demystifying WS-Security, WS-Policy, SAML, XML Signature, and XML Encryption, Sams, 2004. Hansen, M. D.: SOA Using Java(TM) Web Services, Prentice Hall, 2007.
- Graham, S. et al.: Building Web Services with Java: Making Sense of XML, SOAP, WSDL and UDDI, Sams, 2nd edition, 2004.

SOFTWARE DEVELOPMENT FOR MOBILE DEVICES
INJV321

Topics:

Electromagnetic waves in telecommunication, Wireless networks. IEEE 802.11 (WiFi),
802.11a, 802.11b. Bluetooth. Generation of cellular phones GSM, GPRS. WAP 1.0, 2.0, WML, XHTML, i-mode. OBEX. Symbian OS, Windows Mobile. Java2 platform, J2ME. Configuration and profil, CDC, CLDC 1.0, 1.1 (JSR 30, 139), MIDP 1.0, 2.0 (JSR 37, 118), J2ME MIDP application development, JTWI (JSR 185). JSR 120 (Wireless Messaging API), JSR 135 (Mobile Media API), JSR 82 (Java APIs for Bluetooth).

Compulsory/Recommended Readings:

- Tanenbaum, A. S.: Computer networks, Pearson Education, 4th edition, 2002. Hopkins, B., Antony, R.: Bluetooth for Java, Apress, 2003. Piroumian, V.: Wireless J2ME Platform Programming, Sun Microsystems Press, 2002.
- Java 2 Platform, Micro Edition (J2ME): http://java.sun.com/j2me

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TECHNOLOGY OF DEVELOPMENT OF INTERNET APPLICATIONS
INJV341

Topics:

Client-server model, -layer applications, TCP/IP model. TCP/IP programming in Java,
HTTP protocol, question, answer. HTML, XHTML. CGI, PHP, JavaScript, Java applets. A Java2 platform, Java ervlets, JSP, J2EE. Comparing of .NET and J2EE. JTWI-J2EE example. Distributed OO technologies CORBA, Java IDL.

Compulsory/Recommended Readings:

Tanenbaum, A. S.: Computer networks, Pearson Education, 4th edition, 2002. Hunter, J.: Java Servlet Programming, O'Reilly, 2001. Vogel, A., Duddy, K.: Java Programming with CORBA, John Wiley & Sons, 1997. Java 2 Platform, Enterprise Edition (J2EE): http://java.sun.com/j2ee
Object Management Group: http://www.omg.org

INFORMATION THEORY
INJV131

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 chanels. Basic notions of error correcting encoding.

Compulsory/Recommended Readings:

MacKay, D.: Information Theory, Inference, and Learning Algorithms, Cambridge University Press, Cambridge, 2003.
Hankersson, D. R., Harris, G. A., Johnson, P. D.: Introduction to Information Theory and Data Compression, CRC Press, 1997.
Gray, R. M.: Entropy and Information Theory, Springer, New York, 1990. 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.

DATA SECURITY
INJV581

Topics:
Mathematical backgrounds (elementary number theory, algebraic structures, complexity theory). Pseudo random number generators. Classical cryptographic methods: Caesar, affine, substitutional, Vigenére 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. Massage 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, J., Hardjono, T., Seberry, J.: Fundamentals of Computer Security, Springer, 2010.

CODING THEORY
INJV181

Topics:
Mathematical backgrounds. Block codes, error detection and correction, code distance, connection with error detection and correction. Linear codes, Hamming-weight, generating- matrix, check matrix, syndrome, dual codes, standard decoding. Limits and asymptotic limits, (Hamming, Singleton), perfect codes, Hamming-codes. Cyclic codes, BCH-codes, nonlinear codes. Hadamard-matrix, Reed-Müller codes. Combination of codes.

Compulsory/Recommended Readings:

- McWilliams, F. J., Sloane, N. J.: The Theory of Error-correcting Codes, North- Holland, Amsterdam, 1977.
- van Lint, J. H.: Introduction to Coding Theory, Springer-Verlag, Berlin, 1999.
- Roman, S.: Introduction to Coding and Information Theory, Springer-Verlag, Berlin,1996.
- Berlekamp, E. R.: Algebraic Coding Theory, Aegean Park Press, 1984.

INTERNET
MARKETING
INJVM41

Topics:
Introduction to Internet Marketing, Framing the Marketing Opportunity and Strategic Internet
Marketing, Environmental Analysis in Internet Marketing, Ethics and Legal Issues, Marketing Knowledge and Data, Consumer Behavior and the Internet, Segmentation, Targeting & Positioning, Pricing, Product/Branding, Distribution Strategies, Communications, Customer Relationship Management.

Compulsory/Recommended Readings:

- Hanson, W., Kalyanam, K.: Internet Marketing and e-Commerce, South-Western
  College Pub., 2006.
- Rayport, J. F., Jaworski, B. J.: E-Commerce, McGraw-Hill/Irwin, 2001.

INTERNATIONAL MARKETING
INJVM71

Topics:
The topics discussed in this course are the following: Introduction, orientation, Concepts of International Marketing, Motivators, Obstacles, Macroenvironmental Analysis I., Macroenvironmental Analysis II., International Market Research, International Segmentation, Entry Modes, Product Policy, Distribution Policy, Promotion Policy, Price Policy, Special Topics in International Marketing

Compulsory/Recommended Readings:

- Cateora, P., Graham, J.: International Marketing, McGraw.Hill Irwin, 13th edition, 2007.

E-MANAGEMENT
INJVM51

Topics:
This course deals with the impact of modern information and communication technology on leadership, organization structures, external relationships, intercompany collaborations. The most important topics are: economic and social impact of infocommunication's innovation's waves, the characteristics of digital economy, integrated, expanded real time electronic company model, supply chains, networks and virtual organizations, the impact of technology on organizational structures, work design, employment and collaboration forms.

Compulsory/Recommended Readings:

- Brynjolfsson, E., Kahin, B. ed.: Understanding the Digital Economy, The MIT Press, 2000.
- Cairncross, F.: The Company of the Future, Harvard Business School
- Press, 2002. Malone, T.: The Future of Work, Harvard Business School Press, 2004.
- How about Now? The attachment of The Economist, February 2002. Case studies.

APPLICATIONS OF PROBABILITY THEORY
INJV161

Topics:
Stochastic models and their statistics. Random walk (arcsine law, large deviations, law of the iterated logarithm, ruin problems). Point processes (Poisson process). Branching processes (Galton-Watson process, continuous time Markovian branching process). Time-series (AR and ARMA models).

Compulsory/Recommended Readings:

- Taylor, H. M., Karlin, S.: An introduction to stochastic modeling, Academic Press INJ., San Diego, CA, 1998.
- Taylor, H. M., Karlin, S.: A first course in stochastic processes, Academic Press, New York-London, 2nd edition, 1975.
- Taylor, H. M., Karlin, S.: A second course in stochastic processes, Academic Press INJ., New York-London, 1981.
- Bharucha-Reid, A. T.: Elements of the theory of Markov processes and their applications, Dover Publications, Mineola, NY, 1997.
- Guttorp, P.: Stochastic modeling of scientific data, Chapman & Hall, London, 1995.

Free choice

HUMAN RESOURCE MANAGEMENT
INJFM21

Topics:
I. Foundations and Framework:Development of Human Resource Management (HRM) in Historical and International Perspective. The Goals of HRM. The Strategic Management and HRM. Organisational Theory. Labour Process Perspective and HRM. Human Resource Management and the Worker: Towards a New Psychological Contract? HRM and Societal Embeddedness.
II. Core Process and Functions Work Organisation and HRM. Employee Voice (Participation) Systems. Recruitment Strategy, selection decision making. Training Development and Competence. Formal Qualification Based versus Situational Learning and Knowledge. Remuneration: Pay Effects at Work and Performance Management.
III. Patterns and Dynamics HRM and Contemporary Manufacturing. Service Strategies: Marketing, Operations, and HRM Practices. Knowledge Workers, New Public Management and HRM. Transnational Firms and Cultural Diversity. Organisational Cultures in an International Perspective.

Compulsory/Recommended Readings:

- Boxal, P., Purcell, J., Wright, P.: Oxford Handbook of HRM, Oxford University Press, Oxford, 2008.
- Makó, Cs., Moerel, H., Illéssy, M., Csizmadia, P. (eds.): Working It Out? The Labour Process and Employment Relations in the New Economy, Akadémiai Kiadó, Budapest, 2007.

SYSTEM ENGINEERING
INJF501

Topics:
Process of system development, life cycle models. Creating plan documentation. Feasibility, requirements analysis. Input/output design (HIPO). Designing logical and physical data structure. Designing procedures, dialogues and reports. Transaction planning, real time systems. Project development, project management. Cost and risk analysis, the COCOMO modell. Planning system test, making ProtoType. Graphical tools and diagrams. Structured methods: SDM, SSADM. Computer aided system engineering tools (CASE).

Compulsory/Recommended Readings:

- Yourdon, E.: Modern Structured Analysis, Prentice Hall, 1989.
- Davis, W. S., Yen, D. C.: The information system consultant's handbook, Systems
  analysis and design, CRC Press, 1999.

PERFORMANCE EVALUATION OF COMPUTER NETWORKS
INJF541

Topics:
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 in performance analysis. 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, 2004.

KNOWLEDGE BASED SYSTEMS INJV441

Topics:
Architecture and developing of knowledge based systems. Expert systems. Knowledge base and reasoning. Knowledge representation: semantic net, frame based and rule based systems, description logic. Reasoning methods, case based reasoning. Non-deterministic and fuzzy concepts. Case studies.

Compulsory/Recommended Readings:

- Ullman, J. D.: PrINJiples of Database and Knowledge-Base Systems, Computer Science Press, 1989.

INFORMATION ECONOMICS
INJF521

Topics:
The impact of information technology to the economy, mass production versus personal design, types of personal design, key factors of the design, the measurement of product quality, e-marketing, internet economics, modularity, non-typical employment, modular organisations, the change of markets, dynamic pricing.

Compulsory/Recommended Readings:

- Bichler, M.: The Future of e-Markets. Cambridge University Press, Cambridge, 2001.
- Mandel, M.: The Coming Internet Depression - Why the High-Tech Boom Will Go Bust, Why the Crash Will Be Worse Than You Think, and How to Prosper Afterwards. USA, Basic Books, 2000.

STATISTICS WITH COMPUTER
INJV151

Topics:
Basic data analysis: descriptive statistics and graphics. Hypothesis testing. Analysis of variance: one-way and two-way models. Regression analysis. General linear model, OLS estimator. Contingency table, log-linear models. The R language.

Compulsory/Recommended Readings:

SAS OnlineDoc 9.1.3 for the Web
Everitt, B. S., Hothorn, T.: A handbook of statistical analysis using R. Chapman & Hall, 2006.

ECONOMIC HISTORY 1
INJFV11

Topics:
Introduction: basic facts about development and underdevelopment, the relations of economic history to economics; economic development in ancient times; economic development in medieval Europe; Non-Western Economies on the Eve of Western Expansion; Europe's Second Logistic; Economic Nationalism and Imperialism; the Dawn of Modern Industry; Economic Development in the 19th Century; Patterns of Development: Early Industrializers, Patterns of Development: Latecomers and No-Shows; the Growth of the World Economy; The World economy in the 20th century.

Compulsory/Recommended Readings:

- Cameron, R., Neal, L.: A Concise Economic History of the World: From Paleolithic Times to the Present, Oxford University Press, USA, 2002.

ECONOMIC HISTORY 2
INJFV12

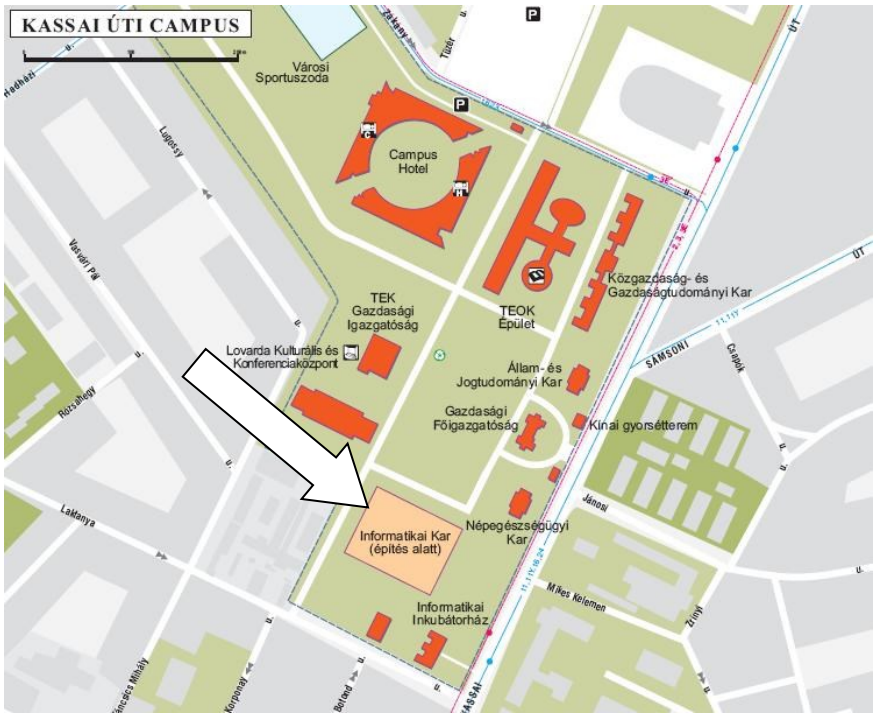
Topics:
The Emerging West as an Ideal and Model for the East, Romanticism and Nationalism in Eastern and Western Europe; Uprisings and Reforms: the Struggle for Independence and Modernization; Economic Modernization in the Half Century before World War I; Social Changes: "Dual" and "INJomplete" Societies; The Political System: Democratization versus Authoritarian Nationalism; Protectionism and Nationalism Between the two World Wars; Varieties of Communist Dictatorship; the Fall of the Communist System; On the way to Europe: Central and Eastern Europe in the Ninties.

Compulsory/Recommended Readings:

- Berend T., I.: History Derailed: Central and Eastern Europe in the Long 19th Century, Uiversity of California Press, 2003.
- Berend T., I., Csató, G.: Evolution of the Hungarian Economy 1848-2000, East European Monograph, 2002.
- Muraközy, L.: Yet Another Change of System – What can be learnt from history and what cannot, Competitio Book Series Vol. 3., University of Debrecen, Debrecen, 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


SUSCOMTEC
SUSTAINABILITY
European Student Meeting
Debrecen, Hungary
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