UNIVERSITY OF DEBRECEN
FACULTY OF INFORMATICS

BSc degree courses
MSc degree courses
PhD courses
Research

Software Information Technology MSc

2011
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Foreword by the Dean

Dear Reader,

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

The pace of change has been breathtaking over the past decades, especially in the field of information technology. The computer has become a common household object. Today, computers and software are not only integral elements of companies’ managements and civil administrations, but have become an inseparable part of our everyday lives, and the Internet gives us virtually instantaneous access to an almost limitless pool of information.

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

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

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

Sincerely,

Dr. György Terdik, Dean
The University of Debrecen, like other integrated institutions of higher education in Hungary, was formed, on 1 January 2000, through the (re)merging of several hitherto autonomous institutions. Its historical roots stretch back to the foundation of the Reformed College of Debrecen (1538), the three academic sections of which later served as the foundation for the Hungarian Royal University of Sciences, created by Statute XXXVI of 1912. This makes the University of Debrecen, with its uninterrupted 450-year history, the oldest institute of higher education in the country to have operated continuously in the same town. Higher education in agriculture began in 1868, when the National Higher School of Agriculture was formed in Debrecen.

With a student body of 34,000 and a 1,700-strong teaching staff, the University of Debrecen is without a doubt one of the largest higher-education institutions in the country, and with its 15 faculties, two independent institutes and 25 doctoral schools (both these figures are highest in the country), it also offers the widest range of educational and research opportunities.

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

This outstanding centre of academic excellence, with its vast educational and R+D capacity, is an increasingly important factor influencing the economic and social development, and the cultural progress, of the region. It devotes special attention to serving the needs of a knowledge-based economy, and fulfilling the role of a regional knowledge centre. UD is one of the five Hungarian universities that have been awarded the prestigious ‘research university’ title by the Ministry of Education in 2010.
Faculty of Informatics

The Faculty of Informatics at the University of Debrecen boasts the only accredited university-level educational program for IT specialists in the east-Hungarian region. The six professors, 19 associate professors (senior staff), 29 assistant professors (staff), 16 teaching assistants and 5 graduate computer scientists working at the faculty’s seven departments (Department of Applied Mathematics and Probability Theory, Information Technology, Computer Graphics and Image Processing, Library Informatics, Informatics Systems and Networks, Computer Science, Affiliated Department of ICT Systems Operation), represent a formidable pool of intellectual potential, which has earned recognition even at international level.

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

The number of students at the faculty increases every year. There are currently around 2,300 students studying the specialisations in Hungarian. We started to teach our courses in English in 2007, the number of students is growing year by year.
Computer equipment at the Faculty

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

In August of 2011 the faculty moves to a new building.

The data network

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

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

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

The majority of computers in the classrooms are Intel Pentium IV-based, and connect to the Faculty’s LAN with 100 Mbit/s network adapters. All computer laboratories are equipped by overhead projectors and we have 3 mobile projectors too. Some of the machines are connected to peripherals such as multifunctional devices, printers and scanners, to further assist the staff and students in their work. The pool of computer equipment used by staff and students is constantly being improved and upgraded.

Library

The work of students and teachers alike is greatly assisted by the extremely well-stocked – even by international standards – library of specialist literature, operated jointly with the Institute of Mathematics, as well as the books and other supplementary educational materials continuously developed in-house by the Facility staff, which are also accessible online.
BSc Degree Courses

Software Information Technology

Aim of the course:

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

Length of course

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

Language: Hungarian, English

Engineering Information Technology

Aim of the course:

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

Length of the course

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

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

Language: Hungarian, English

Specialisations:

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

Aim of the course:

To train IT professionals who are capable of understanding and resolving the specific business processes underlying the information-based society, managing the IT tasks that support value-creating processes, and, making the best use of the opportunities presented by modern information technology in order to increase the knowledge base and business intelligence of organisations, to model processes based on interaction between 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 possess the depth of theoretical knowledge necessary to continue their training in the second cycle.

Length of the course

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

Language: Hungarian, English

Specialisations:
- Corporate management
- E-business

Library and Information Science

Aim of the course

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

Length of course:

- Number of semesters: 6
- Number of credits required to obtain degree: 180
- Number of teaching (contact) hours: 2,250
- Compulsory vocational practice: 120 hours after the second semester and 220 hours in the 5-6th semesters.

Language: Hungarian

Specialisation:
- Web programmer
Master’s Degree Courses

Software Information Technology

Aim of the course:

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

Length of course:

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

Language: Hungarian, English

Specialisations:

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

Business Information Technology

Aim of the course:

To train IT professionals who are capable of understanding and resolving the specific business processes underlying the information-based society, managing the IT tasks that support value-creating processes, and, making the best use of the opportunities presented by modern information technology in order to increase the knowledge base and business intelligence of organisations, to model processes based on interaction between 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 possess the depth of theoretical knowledge necessary to continue their training in PhD Schools.

Length of the course

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

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

Library Information Sciences

Aim of the course

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

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

Language: Hungarian

Teacher – Teacher of Informatics
Course in Hungarian

Teacher – Teacher of Library-pedagogy
Course in Hungarian
PhD Courses

PhD School of Informatics

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

Programs:

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

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

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

Following the so called “Bologna’ Process” structure, two levels (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, including the “Communication technologies”. The CCNA courses are offered for the students of the “Communication technologies” direction as a “direction mandatory course”. The CCNA courses take high number of lectures, practical and labor studies: two semesters, 120 hours per semester. Usually there are two groups for full-time students (10-16 students per group), and one group for part-time students. The clear aim of the CCNA courses is to get theoretically and practically strong and deep internationally accepted level of networking knowledge for the students.

The most important and most interesting parts of the CCNA courses are the practical and labor lessons. The study catalogs show, that almost 100 percent of the students are present on all of the labors. Students work in a team to solve different configuration and error detection/correction labor tasks during the semester. We recognized the high students’ interest for the laboratory work, and also it was clear to see, that the equipment (router and switch) usage of the Cisco laboratory is very low (only 30-40 hours per week). In order to
solve this “bottleneck problem”, a software system was developed, which opened the possibility for the students to use the equipments of the Cisco laboratory from home (according to a well prepared scheduling). The remote access system works perfectly since 2005, and it has duplicated the usage ratio of our laboratory equipments. Each student must solve a quite complicated practical exam at the end of the semesters (applying a 3 hours time limit), which needs very strong and deep knowledge both on the theoretical and practical fields. As a result, 50-60 percent of the students successfully pass the international VUE CCNA (640-802) exam for the first trial. This ratio is one of the highest in the Hungarian Cisco Academies, but it is very high in the international context too. The faculty would like to increase further the networking knowledge of the informatics professional students, so a CCNP teaching environment was established (certified instructors, equipments, etc.), and the CCNP courses for students were started in February of 2010.

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

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

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

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

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

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

Periodicals

Publicationes Mathematicae Debrecen

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

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

The Béla Gyires IT Lectures

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

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

Department of Applied Mathematics and Probability Theory

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

Email: fazekas.istvan@inf.unideb.hu
www: http://www.inf.unideb.hu/valseg/index_angol.html

Research fields

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

Department of Informatics Systems and Networks

Head of Department: Dr. János Sztrik, Full professor

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

Research fields

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

Head of Department: Dr. habil György Terdik, Full professor

Email: terdik.gyorgy@inf.unideb.hu
www: http://infotech.inf.unideb.hu/index.html

Research fields

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

Department of Computer Science

Head of Department: Dr. Attila Pethő Full professor, corresponding member of Hungarian Academy of Sciences

Email: petho.attila@inf.unideb.hu
www: http://www.inf.unideb.hu/szamtud/

Research fields

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

Head of Department: Dr. habil András Hajdu Associate professor

Email: hajdu.andras@inf.unideb.hu
www: http://www.inf.unideb.hu/grafika/main_e.html

Research fields

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

Department of Library Informatics

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

Email: gilanyi.attila@inf.unideb.hu
www: http://www.inf.unideb.hu/~bodai/kinformatika/

Research fields

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

Affiliated Department of ICT Systems Operation

Head of Department: Péter Ilosvai

Email: peter.ilosvai@it-services.hu

www: http://www.it-services.hu/index.php?content=64
Software Information Technology MSc Course

Aim of the course:

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

Length of course

- Number of semesters: 4.
- Number of credits required to obtain degree: 120.

| Credits |
|------------------|------------------|------------------|------------------|------------------|
| Common Science basic subjects | 30 |
| Vocational basic subjects | 48 |
| Vocational subjects | 16 |
| Vocational subjects of choice | 6 |
| Thesis | 20 |

Common Science basic subjects

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Credit</th>
<th>Hrs/week</th>
<th>Exam</th>
<th>Prerequisites</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Theor.</td>
<td>PRACTICE</td>
<td>Theory</td>
<td>CR.</td>
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<tr>
<td>INNK110</td>
<td>Applied Mathematics</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>K</td>
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<tr>
<td>INNK120</td>
<td>Computer Science</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>K</td>
<td>A</td>
</tr>
<tr>
<td>INNK130</td>
<td>Applied Statistics</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>K</td>
<td>A</td>
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<tr>
<td>INNK140</td>
<td>Informatikai algoritmusok</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>K</td>
<td>A</td>
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<tr>
<td>INNK150</td>
<td>Modelling Data and Systems</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>K</td>
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</table>

Compulsory vocational subjects (Information Systems-specialization)

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Credit</th>
<th>Hrs/week</th>
<th>Exam</th>
<th>Prerequisites</th>
<th>Period</th>
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<td>Theor.</td>
<td>PRACTICE</td>
<td>Theory</td>
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20
<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<th>ECTS</th>
<th>Type</th>
<th>Institute Code(s)</th>
<th>ECTS</th>
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<tbody>
<tr>
<td>INNV410</td>
<td>Software System Design</td>
<td>6</td>
<td>2</td>
<td>K</td>
<td>INNK150</td>
<td>2</td>
</tr>
<tr>
<td>INNV321</td>
<td>Managing Information Systems</td>
<td>6</td>
<td>2</td>
<td>K</td>
<td>INNK150</td>
<td>2</td>
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<tr>
<td>INNV430</td>
<td>Software Quality Management</td>
<td>4</td>
<td>2</td>
<td>K</td>
<td>INNK150</td>
<td>2</td>
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<tr>
<td>INNV320</td>
<td>Architectures of Information Systems</td>
<td>4</td>
<td>2</td>
<td>G</td>
<td>INNK120, INNK150</td>
<td>2</td>
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<tr>
<td>INNV360</td>
<td>Data Mining</td>
<td>6</td>
<td>2</td>
<td>K</td>
<td>INNK110, INNK130, INNK150</td>
<td>2</td>
</tr>
<tr>
<td>INNV630</td>
<td>Knowledge-based Technology</td>
<td>4</td>
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<td>K</td>
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<td>2</td>
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Exam: TE – terminal examination  
S – sign  
P – practical sign
Subject programs

APPLIED MATHEMATICS


Compulsory/Recommended Readings:

COMPUTER SCIENCE


Compulsory/Recommended Readings:

MODELLING DATA AND SYSTEMS

Theoretical and practical problems of Relational Data Base Systems Functional dependence, standardizing and normal forms. Coupled data manipulations to Relational Data Base models Relational algebra and Relational calculus, SQL. Some problems and some actual issues of data modeling.
Embedded models, ER models OO and OR models. SQL:1999, ODMG 3.0, ODL, OQL. Mapping models with different designs to each other. Modeling information systems (environmental and conducting data and Object oriented models).

Compulsory/Recommended Readings:
- Abiteboul:

ARCHITECTURES OF INFORMATION SYSTEMS


Compulsory/Recommended Readings:

COMPUTER NETWORKS: TECHNOLOGIES AND MODELS

References:


MANAGING INFORMATION SYSTEMS

Information Systems as IT service, IT Infrastructure Library (ITIL). Parts of qualitative supporting IT services: configuration management, event management, problem management, change-/ modification management, server-/ information desk, version - management. Aspects of IT services: layer management, capacity management, continuity management, accessibility management, financing the IT. Security risk analysis, COBRA methodology. Introducing ITIL toolkits.

Compulsory/Recommended Readings:


**ADVANCED DATABASE TECHNOLOGIES**


Compulsory/Recommended Readings:

**DATA MINING**


References:

**KNOWLEDGE BASED TECHNOLOGIES**


Compulsory/Recommended Readings:
NUMERICAL MATHEMATICS

Solution of ordinary differential equations (ODE). (first and higher order ODEs)
Initial-value problems, boundary-value problems.
Explicit and implicit single-, and multi-step methods.
Speed of the convergence, estimation and propagation of the error.
Optimal step-size, adaptive step-size control.
Monte-Carlo methods.
Finite Element Methods.
The use of different methods are shown by the programs in the Numerical Recipes

Literature:


NON-LINEAR OPTIMIZATION


Recommended literature


CONTROL SYSTEMS I

Basic notions in control systems: input, output and state dependence, discrete and continuous time-dependence, differential system, system-diagram. Linear difference equations and difference equations systems. The z-transform and its properties. The inverse of the matrix \( zI - A \). Solution, controllability and observability of the state equation of discrete time linear stationary systems. Laplace transform and its properties. Solution of linear differential equations with constant coefficient using Laplace transforms. System stability and system analysis in frequency-domain. Multidimensional systems. The inverse of the matrix \( sI - A \) and the exponential function of the matrix \( tA \). The Control Systems Toolbox of MATLAB (on seminars).

Literature:

CONTROL SYSTEMS II


Literature:

STATISTICAL LEARNING ALGORITHMS

Compulsory/Recommended Readings:

**DATA MINING APPLICATIONS**


References:

**BIOINFORMATICS**


References:
ENTERPRISE AND PROJECT MANAGEMENT


Compulsory/Recommended Readings:

ENGINEERING OF SOFTWARE SYSTEMS


Compulsory/Recommended Readings:

**IMPLEMENTING INFORMATION SYSTEMS**

Basic issues of implementing Information systems. Aspects of selections for hardware operation systems, developing environments, programming language, database systems, CASE tools and technologies. Purchasing of ready to use systems and developing systems. Models for programming. Working up a User interface. Integration of a system into some operating systems. Integrating systems with different paradigm and technologies. Primitive systems. Data migrations.

Compulsory/Recommended Readings:


**NEW PROGRAMMING PARADIGM**


Compulsory/Recommended Readings:

**PROGRAMMING WITH LOGIC**


Literature:

**KNOWLEDGE REPRESENTATION**

One knowledge representation tool, the description logic is discussed in details. Reasoning: classification, instantiation, tableaux calculus.

Compulsory/Recommended Readings:

**CASE STUDY FOR KNOWLEDGE BASED SYSTEMS**

The students prepare two expert systems using rules based and object oriented knowledge representation tools. Proposed tools: Clips, Level5, M1.

Compulsory/Recommended Readings:

**GEOMETRIC BASES FOR COMPUTER GRAPHICS**

Description
Vector algebra
Basic concepts of projective geometry.
Elements of descriptive geometry.
Expression of spatial relations in drawings.
Main theorems of axonometry.
Basic concepts of differential geometry.
Analytical creation of curves and surfaces.

Compulsory/Recommended Readings:


GIS & Science

The process of data modelling in a geographical information system, representing the real-world in a GIS. The most important reference systems and data collection methods. The quality of data.

Main types of the vector, raster and hybrid data models

Operations in geographical information systems.

Outline of some interesting algorithms concerned in GIS.

Usage a GIS software (currently Autodesk Map) in practice (querying, thematic mapping, topologies and its operations).

References:

- User Guides, Manuals of GIS Softwares

ADVANCED SEARCHING ALGORITHMS

Graph searching and combinatorial optimization problems. Constructive searching algorithms. Local searching techniques: simulated annealing, taboo searching, Hungarian method etc. Constraint satisfaction problems and their representation. Constraint propagation, node and edge consistency, k-consistency. Backjumping, backchecking, backmarking, best-first searching etc. Local methods.

Compulsory/Recommended Readings:


AUTOMATED THEOREM PROVING

Compulsory/Recommended Readings:

**LOGIC PROGRAMMING AND DEDUCTIVE DATABASES**

First-order resolution principle, some important resolution strategies. Principle of logic programming. Relation between logic and logic programming. The logic program. Formalization problems. The relation between PROLOG like logic programs and linear input resolution. The depth first strategy and the parsing of the complete deduction tree in the classical PROLOG systems. Problems coming from the speciality of the PROLOG interpreters / compilers and of the built-in processes. The semantics of PROLOG programs. The Herbrand models, fixpoints. The least fixpoint and the least Herbrand model. Negative information, strategies to treat it and the fixpoints. PROLOG and DATALOG.

Compulsory/Recommended Readings:

**KNOWLEDGE BASED TECHNOLOGIES**

Topics:

Compulsory/Recommended Readings:

**SEMANTIC WEB**

The notion and layers of semantic web. The semantic web, a set of design principles expressed in formal specifications. Some of these include Resource Description Framework (RDF), a variety of data interchange formats (e.g. XML) and notations such as RDF Schema and Web Ontology Language (OWL). Reasoning in the semantic web, description logic. Web services.

Compulsory/Recommended Readings:

**DIGITAL SPEECH PROCESSING**


Compulsory/Recommended Readings:

**NEW COMPUTING PARADIGMS**


Literature:

**NON-CLASSICAL LOGICS**

General characterization of classical logic. Intensional logics as non-classical logics. First attempts of logical treatment of modality: modal syllogisms. Problems of conditionals. C. I. Lewis’ modal calculi: systems of strict implication (S1…S5). Modal
semantics of propositional modal logic, Kripke frames. Consequence-relation in possible world semantics. Connection between modal calculi and modal semantics: completeness theorems. First order modal semantics. De re, de dicto, Barcan schemes. Modal semantics permitting semantic value gap. Type-theoretical intensional logic as a generalization of model logic.

Literature:

**MANY-VALUED LOGICS**


Compulsory/Recommended Readings:

**COMBINATORIAL AND ALGORITHMLI FEATURES OF FORMAL LANGUAGES**


Compulsory/Recommended Readings:
- Pál Dömősi, Sándor Horváth, Masami Ito: Primitive Words and Context-Free Languages, kézirat
PROGRAMMING THEORY


Compulsory/Recommended Readings:


GRAPH-ALGORITHMS

Representation of graphs, search and traverse in graphs, topological sorting, strongly connected components, 2-coloring. Diameter of a graph, minimum spanning tree, shortest path problem.

Literature


SYSTEMS OF FORMAL LANGUAGES


Literature:


AUTOMATA NETWORKS


Literature:

**DNS COMPUTING**


Literature:
The map of the campus

The building of Faculty of Informatics

The new building of Faculty of Informatics
Scenery plans of our new building at the Campus of Kassai street