Software Engineering

BSc Course

2007
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# TABLE OF CONTENTS

## INTRODUCTION
- Computer equipment at the Faculty 6
- The data network 6
- Network devices 7

## DEPARTMENTS
- Department of Applied Mathematics and Probability Theory 8
- Department of Informatics Systems and Networks 8
- Department of Information Technology 9
- Department of Computer Science 10
- Department of the Computer Graphics and Library Informatics 11

## SOFTWARE ENGINEERING BSC COURSE 12

## SUBJECT PROGRAMS 16
Introduction

Dear Reader,

Following pages contain an introduction to the Faculty of Informatics at the University of Debrecen. Our faculty is very new, having been formed in 2004 as the 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 20 students enrolled to study Programming Mathematics. 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 headed by Dr. Ernő Gesztelyi.

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 company management and civil administration, 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 multiplied, and the range of courses we offer has also expanded. At the end of the 1980s, we began providing university-level education in Programming Mathematics, IT Teaching and Library IT. We have also played an active role in the founding and running of the Mathematics and Computer Sciences Doctoral School. Today, the Faculty's five departments employ a total of 70 instructors, who are supported in their work by the Dean’s Office, the Systems Administration Group and the specialist library, which is shared with the Faculty of Natural Science’s Institute of Mathematics. The Faculty of Informatics currently has more than 1,700 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. In 2005 we launched the System Engineering course, and from 2006 we will also run Business Information Management and Library Information Management degree courses. The curricula of the master’s degree courses are also being 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 Mathematics and Computer Sciences Doctoral 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 project, and work as closely possible with local enterprise.

Sincerely,

Dr. Attila Pethő, Dean
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 eight professors, 13 associate professors (senior staff), 17 assistant professors (staff), 15 teaching assistants and 15 graduate computer scientists working at the faculty's five departments (Department of Applied Mathematics and Probability Theory, Information Technology, Computer Graphics and Library Informatics, Informatics Systems and Networks, Computer Science), represent a formidable pool of intellectual potential, which has earned recognition even at international level.

Courses in information technology were first launched in 1972 at the Kossuth Lajos University of Sciences, one of the predecessors to the University of Debrecen, in the form of a Programming Mathematics specialisation at technical-college level. The range of courses was later expanded to include the university-level specialisations of Software Engineering, Information Technology Teaching and Library Information Sciences. In the more than 30 years that have elapsed since then – in response to the growing demands of society – the courses have continued and student numbers have steadily increased.

The aim of the Software Engineering and System Engineering 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 teacher-training courses are designed to produce teachers with a high level of IT, pedagogical and general knowledge, who are proficient teachers of information technology subjects at all levels. They must have an extensive knowledge of the structure of their specialist field, both in respect of the relevant scientific theories and the ever-expanding range of opportunities for their application. The training focuses particularly on developing the skills and abilities that will enable prospective teachers to maintain the valuable traditions and high standards of Hungarian teaching, while helping students to map their careers in a professional environment that will continue to change over the coming decades. An outlook on the European traditions of IT education is also a key element of this specialisation.

The aim of the Library Information Science 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.

The number of students at the faculty increases every year. There are currently around 1,700 students studying the five specialisations, 206 of whom are first-year Software Engineering and System Engineering BSc students. The Faculty of Informatics also runs IT (combined with mathematics) courses at the Faculty of Economics and Business Administration, and offers similar training to students of the University who are not majoring...
in mathematics or IT. The faculty staff plays an important part in the work of the doctoral school, where 8-9 full-time and 10-20 correspondence students enrol every year.

![Number of Students at Faculty of Informatics](image)

**Computer equipment at the Faculty**

The Faculty has 42 rooms in the shared building. The table below gives an overview of the computer equipment installed in these rooms.

<table>
<thead>
<tr>
<th>Device</th>
<th>Number of units</th>
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<tr>
<td>B+W laser printer</td>
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<tr>
<td>Colour laser printer</td>
<td>1</td>
</tr>
<tr>
<td>Ink-jet printer</td>
<td>4</td>
</tr>
<tr>
<td>Scanner</td>
<td>7</td>
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</tbody>
</table>

Other equipment includes 3 fax machines, 30 portable computers and 11 projectors.

**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 10 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 1 Gbit/s. Plans for the near future include replacement of the 10 Mbit switches with 100 Mbit switches.
The building is completely covered by two wireless networks (WiFi): one is servicing the staff the other is servicing students’ requirements.

At present, some 300 desktop PCs and 30 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. (Unfortunately, the ports that serve them currently only operate at a bandwidth of 10 Mbit/s, but these are scheduled to be upgraded in the near future.)

Although the classrooms contain a variety of different computers, the majority are Pentium IV-based. 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. Future plans include providing the Faculty’s instructors with high-performance machines.

The pool of computer equipment used by staff and students is constantly being improved and upgraded.

**Network devices:**

- 1 Cisco Catalyst 3550 network switch, 1/Gbit, 24/100 Mbit (uplink to the other network switches)
- 1 Micronet non-manageable network switch, 16/100 Mbit
- 1 Xylan Omnistack ATM network switch, 1/ATM, 24/100 Mbit
- 5 Xylan Omnistack network switches, 2/100 Mbit, 32/10 Mbit
- 5 Xylan Omnistack network switches, 2/100 Mbit, 32/10 Mbit
- 1 Micronet non-manageable network switch, 16/100 Mbit
- 7 HP Procurve network switches 48/100 Mbit

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.
Departments

Department of Applied Mathematics and Probability Theory

**Head of department:** Dr. Gyula Pap, Full Professor

**Email:** papgy@inf.unideb.hu  
**www:** [http://www.inf.unideb.hu/valseg/index_angol.html](http://www.inf.unideb.hu/valseg/index_angol.html)

**Members of Department:**

- Pál Burai: Assistant Lecturer
- Erik Bajalínov: Senior Lecturer
- Ágnes Baran: Assistant Lecturer
- Sándor Baran: Associate Professor
- Norbert Bátfai: Research Fellow
- Mátyás Barczy: Assistant Lecturer
- István Fazekas: Associate Professor
- Endre Iglói: Research Fellow
- Márton Ispány: Associate Professor
- Péter Jeszenszky: Assistant Lecturer
- István Kalmár: Lecturer
- Péter Major: Part time Professor
- Csaba Noszály: Research Fellow
- Zsolt Pérez: Research Fellow
- Gisbert Stoyan: Part time Professor
- Tamás Vertse: Part time Professor
- Béla Glevitzky: R. Lecturer
- Márti Nagy: R. Lecturer

**Research fields**

- Probability theory
- Mathematical statistics
- Operation research
- Numerical mathematics
- JAVA technology

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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](http://irh.inf.unideb.hu/english/index_angol.htm)

**Members:**

- Tamás Bérczes: Assistant Lecturer
- Béla Almási: Associate Professor
- Attila Kuki: Lecturer
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, Associate Professor

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

Attila Adamkó Research Fellow
Mátyás Arató Professor emeritus
András Bölcskei Associate Professor
Gábor Fazekas Associate Professor
Miklós Espák Research Fellow
András Hajdu Lecturer
Gábor Halász Associate Professor
István Juhász Lecturer
Tamás Krausz Lecturer
Lajos Kollár Research Fellow
Gergely Kovásznai Research Fellow
Márk Kósa Research Fellow
Éva L. Nagy Research Fellow
Katalin Juhász Senior Lecturer
János Pánovics Research Fellow
Krisztián Veréb Lecturer

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. Pál Dömösi Full Professor

Email: domosi@inf.unideb.hu
www: http://www.inf.unideb.hu/szamtud/

László Aszalós Lecturer
Péter Battyányi Assistant Lecturer
Katalin Bognár Senior Lecturer
László Csirmaz Part time Senior Lecturer
Attila Fazekas Associate Professor
Tamás Herendi Lecturer
Géza Horváth Lecturer
Zoltán Mecsei Research Fellow
Tamás Mihálydeák Associate Professor
Benedek Nagy Assistant Lecturer
Zoltán Papp Lecturer
Attila Pethő Full Professor
Magda Várterész Associate Professor
Katalin Pásztorné Varga Associate Professor

Research fields

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

Head of department: Dr. habil Sándor Bácsó Associate Professor

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

Dániel Benediktsson Lecturer
István Boda Associate Professor
Marianna Bodroginé Zichar Assistant Lecturer
Gyöngyi Bujdosó Assistant Lecturer
Mária Eszenyné Borbély Part time Research Fellow
Sarolta Fazekas Part time assistant
Barna György Iszály Research Fellow
Béláné Kovács Research Fellow
Emódi Kovács Lecturer
Gábor Ledeczky Assistant Lecturer
Ildikó Papp Lecturer
Marianna Salgáné Medveczki Lecturer
Tibor Schwarcz Lecturer
Henrietta Tomán Assistant Lecturer
Róbert Tornai Lecturer
Miklós Bényei R. Associate Professor
Györgyi Suppné Tarnay R. Lecturer
József Szabó R. Professor

Research fields

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

Library and information science
• 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
Software Engineering BSc Course

Course available from: September 2007

Aim of the course:

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

Length of course

- Number of semesters: 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.

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<td>Optional vocational subjects of choice</td>
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<td>Optional natural science subjects</td>
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<td>Other optional subjects</td>
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**Compulsory vocational subjects of choice subjects**

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Exam: TE – terminal examination  
S – sign  
P – practical sign
# Subject programs

**DISCRETE MATHEMATICS 1**  
PIBA01  
Semester: 1  
Type: Lecture/seminar  
Classes/week: 2+2  
ECTS Credit points: 4  
Prerequisites: none  
Responsible: Sándor Bácsó

<table>
<thead>
<tr>
<th>Topics:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural numbers, operations, sorting, mathematical induction. Integers, rational numbers, real numbers, cardinality. Complex numbers, its canonic, trigonometric and exponential forms, nth root, roots of unity. Irrational, algebraic and transcendental numbers.</td>
</tr>
<tr>
<td>Finite-dimensional vector spaces, subspace, linear independence, basis, dimension,. Matrix algebra; invertibility of matrices, rank. Properties of determinants, formula to expand the determinant along a row or column, theory of product matrix product theorem. Solvability assumptions of homogeneous and inhomogeneous systems of linear equations, characterization solution set, determing of general solution.</td>
</tr>
</tbody>
</table>

**Compulsory/Recommended Readings:**

CALCULUS 1
PIBA02
Semester: 1
Type: Lecture/Seminar
Classes/week: 2+2
ECTS Credit points: 4
Prerequisites: none
Responsible: Gyula Maksa

Topics:
Series, convergence, absolute convergence, convergence criteria. Series of positive terms, reordering.

Compulsory/Recommended Readings:

LOGIC IN COMPUTER SCIENCE
PIBA03
Semester: 1
Type: Lecture/Seminar
Classes/week: 2+2
ECTS Credit points: 4
Prerequisites:
Responsible: Attila Fazekas

Topics:

Compulsory/Recommended Readings:

INTRODUCTION TO INFORMATICS
PIBA04
Semester: 1
Type: Lecture/Labor
Classes/week: 2+2
ECTS Credit points: 4
Prerequisites:
Responsible: András Bölcskei

Topics:

Compulsory/Recommended Readings:

COMPUTER ARCHITECTURES
PIBA05
Semester: 1
Type: Lecture
Classes/week: 2+0
ECTS Credit points: 3
Prerequisites:
Responsible: Gábor Fazekas

Topics:

Compulsory/Recommended Readings:

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ASSEMBLY LANGUAGES
PIBA06
Semester: 1
Type: Lecture/Labor
Classes/week: 2+2
ECTS Credit points: 4
Prerequisites:
Responsible: Gábor Halász

Description:

Compulsory/Recommended Readings:

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AUTOMATA AND FORMAL LANGUAGES
PIBA09
Semester: 1
Type: Lecture/Seminar
Classes/week: 2+2
ECTS Credit points: 4
Prerequisites:
Responsible: Pál Béla Dömösí

Topics:
Main types of formal systems and automata. Languages and grammars, normal forms. Formal languages and automata. Chomsky hierarchy. Operations on

Compulsory/Recommended Readings:

DISCRETE MATHEMATICS 2
PIBA07

Semester: 2
Type: Lecture/Seminar
Classes/week: 2+2
ECTS Credit points: 4
Prerequisites: PIBA01
Responsible: Sándor Bácsó

Topics:
Elements of mathematical statistics. Mean, standard deviation; usage of tables.
Fundamentals of graph theory. Graphs, oriented graphs, matrix representation, routes, cycles, special graphs and their properties.

Compulsory/Recommended Readings:
CALCULUS 2
PIBA08
Semester: 2
Type: Lecture/Seminar
Classes/week: 2+2
ECTS Credit points: 4
Prerequisites: PIBA02
Responsible: Gyula Maksa

Topics:

Compulsory/Recommended Readings:

DATA STRUCTURES AND ALGORYTHMS
PIBA10
Semester: 2
Type: Lecture/Seminar
Classes/week: 2+2
ECTS Credit points: 4
Prerequisites: PIBA04
Responsible: András Bölcskei

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

Compulsory/Recommended Readings:

PROGRAMMING LANGUAGES 1
PIBA11
Semester: 2
Type: Lecture/Labor
Classes/week: 2+2
ECTS Credit points: 5
Prerequisites: PIBA04
Responsible: István Juhász

Topics:

Compulsory/Recommended Readings:

OPERATING SYSTEMS 1
PIBA12
Semester: 2
Type: Lecture/Labor
Classes/week: 2+2
ECTS Credit points: 4
Prerequisites: PIBA04
Responsible: Gábor Fazekas

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 (Win. NT, Unix/Linux/Solaris).

**Compulsory/Recommended Readings:**
- Silberschatz, Abraham, Operating system concepts, Addison-Wesley, c1994, xvi, 780 p. : ill. ; 25 cm, ISBN 0 201 59292 4

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**COMBINATORICS AND PROBABILITY THEORY**

PIBA13

**Semester:** 2  
**Type:** Lecture/Seminar  
**Classes/week:** 2+2  
**ECTS Credit points:** 4  
**Prerequisites:** PIBA01, PIBA02  
**Responsible:** Gyula Pap

**Topics:**

**Compulsory/Recommended Readings:**
COMPUTERSTATISTICS
PIBA63
Semester: 3
Type: Lecture/Labor
Classes/week: 2+2
ECTS Credit points: 4
Prerequisites: PIBA13
Responsible: István Fazekas

Topics:

Compulsory/Recommended Readings:

PROGRAMMING LANGUAGES 2
PIBA14
Semester: 3
Type: Lecture/Labor
Classes/week: 2+2
ECTS Credit points: 5
Prerequisites: PIBA10, PIBA11
Responsible: István Juhász

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

Compulsory/Recommended Readings:

DATABASE SYSTEMS
PIBA15
Semester: 3
Type: Lecture/Labor
Classes/week: 2+2
ECTS Credit points: 5
Prerequisites: PIBA03, PIBA10, PIBA11
Responsible: János Kormos

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

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

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

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

Study of a concrete DBMS

Compulsory/Recommended Readings:

SYSTEM ENGINEERING
PIBA16
Semester: 3
Type: Lecture
Classes/week: 2+0
ECTS Credit points: 3
Prerequisites: PIB11
Responsible: András Bölcskei

Topics:
Compulsory/Recommended Readings:

INTRODUCTION TO COMPUTER GRAPHICS
PIBA17
Semester: 3
Type: Lecture/Labour
Classes/week: 2+2
ECTS Credit points: 4
Prerequisites: PIBA02, PIBA11
Responsible: József Szabó

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

Compulsory/Recommended Readings:

OPERATING SYSTEMS 2
PIBA18
Semester: 3
Type: Lecture/Labour
Classes/week: 2+2
ECTS Credit points: 4
Prerequisites: PIB12
Responsible: Gábor Fazekas

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

Compulsory/Recommended Readings:
- Silberschatz, Abraham, Operating system concepts, Addison-Wesley, c1994, xvi, 780 p. : ill. ; 25 cm, ISBN 0 201 59292 4
THEORY OF COMPUTING
PIBA20

Semester: 4
Type: Lecture
Classes/week: 2+0
ECTS Credit points: 3
Prerequisites: PIBA03, PIBA10
Responsible: Attila Pethő

Topics:

Compulsory/Recommended Readings:

PROGRAMMING ENVIRONMENTS
PIBA21

Semester: 4
Type: Labor
Classes/week: 0+2
ECTS Credit points: 2
Prerequisites: PIBA14
Responsible: Gábor Fazekas

Topics:

Compulsory/Recommended Readings:
NUMERICAL MATHEMATICS  
PIBA22  
Semester: 4  
**Type:** Lecture/Labor  
**Classes/week:** 2+2  
**ECTS Credit points:** 4  
**Prerequisites:** PIB07, PIB08, PIB11  
**Responsible:** István Fazekas

**Topics:**  

**Compulsory/Recommended Readings:**  

OPERATIONS RESEARCH  
PIBA23  
Semester: 4  
**Type:** Lecture/Labor  
**Classes/week:** 2+2  
**ECTS Credit points:** 4  
**Prerequisites:** PIBA07, PIBA08, PIBA11  
**Responsible:** Erik Bajalinov

**Topics:**  
Network models. Blending problem. Modeling for special cases.
Compulsory/Recommended Readings:


INTRODUCTION TO ARTIFICIAL INTELLIGENCE
PIBA24
Semester: 4
Type: Lecture/Seminar
Classes/week: 2+2
ECTS Credit points: 5
Prerequisites: PIBA14
Responsible: Magda Várterész
Topics:

Compulsory/Recommended Readings:


DATABASE SYSTEM IMPLEMENTATION
PIBA25
Semester: 4
Type: Lecture
Classes/week: 2+0
ECTS Credit points: 2
Prerequisites: PIBA15
Responsible: János Kormos

Topics:

Compulsory/Recommended Readings:

PROGRAMMING TECHNOLOGIES
PIBA26
Semester: 4
Type: Lecture/Labor
Classes/week: 2+2
ECTS Credit points: 4
Prerequisites: PIBA14
Responsible: István Juhász

Topics:

Compulsory/Recommended Readings:

TECHNOLOGY OF SYSTEM DEVELOPMENT
PIBA27
Semester: 5
Type: Lecture/Labor
Classes/week: 2+2
ECTS Credit points: 4
Prerequisites: PIBA16, PIBA26
Responsible: János Kormos
Topics:

Compulsory/Recommended Readings:

COMPILERS
PIBA28
Semester: 5
Type: Lecture/Labor
Classes/week: 2+2
ECTS Credit points: 4
Prerequisites: PIBA09, PIBA14, PIBA18
Responsible: Pál Béla Dömösi

Topics:

Compulsory/Recommended Readings:

COMPUTER NETWORKS (ARCHITECTURES AND PROTOCOLS)
PIBA29
Semester: 5
Type: Lecture + Labor
Classes/week: 2+2
ECTS Credit points: 4
Prerequisites: PIBA05, PIBA18
Responsible: Béla Almási

Topics:
Network topologies and architectures. Transmission media, analog and digital transmission signaling and coding. Switching methods. The ISO OSI reference

Compulsory/Recommended Readings:
- RFC Documents: http://www.rfc-editor.org/

DEVELOPING AND ANALYSING ALGORITHMS
PIBA31
Semester: 6
Type: Lecture/Seminar
Classes/week: 2+2
ECTS Credit points: 5
Prerequisites: PIBA03, PIBA09, PIBA14
Responsible: Zoltán Papp

Topics:

Compulsory/Recommended Readings:
- E. W. Dijkstra, Guarded Commands, nondeterminacy and formal derivation of Programs, Comm. of the ACM 18, 1975.

INTERNET TOOLS AND SERVICES
PIBA32
Semester: 6
Type: Lecture
Classes/week: 2+0
ECTS Credit points: 2
Prerequisites: PIB12
Responsible: Katalin Juhász
Topics:

Compulsory/Recommended Readings:

PROGRAMMING LANGUAGES OF ARTIFICIAL INTELLIGENCE
PIBA34
Semester: I
Type: Lecture/Labor
Classes/week: 2+2
ECTS Credit points: 4
Prerequisites: PIBA19, PIBA24
Responsible: László Aszalós

Topics:

Compulsory/Recommended Readings:

KNOWLEDGE BASED SYSTEMS
PIBA35
Semester: I
Type: Lecture/Labor
Classes/week: 2+2
ECTS Credit points: 4
Prerequisites: PIBA19, PIBA24
Responsible: Katalin Bognár

Topics:

Compulsory/Recommended Readings:

THEORY OF LOGIC PROGRAMMING
PIBA36
Semester: I
Type: Lecture
Classes/week: 2+0
ECTS Credit points: 2
Prerequisites: PIBA19
Responsible: Magda Várterész

Topics:

Compulsory/Recommended Readings:

SOME ASPECTS OF ARTIFICIAL INTELLIGENCE
PIBA37
Semester: I
Type: Lecture
Classes/week: 2+0
ECTS Credit points: 2
Prerequisites: PIBA19, PIBA24
Responsible: Katalin Bognár

Topics:
Some advanced topics in Artificial Intelligence are discussed (among others: searching algorithms, restriction satisfaction, machine learning, multi agent systems, speech recognition, etc.) Notions, methods, tools and applications.

Compulsory/Recommended Readings:
DATABASE SYSTEM IMPLEMENTATION 2
PIBA38
Semester: I
Type: Lecture
Classes/week: 2+0
ECTS Credit points: 2
Prerequisites: PIBA19, PIBA25
Responsible: János Kormos

Topics:

Compulsory/Recommended Readings:

OO DATAMODELS
PIBA39
Semester: I
Type: Lecture
Classes/week: 2+0
ECTS Credit points: 2
Prerequisites: PIBA19
Responsible: András Hajdu

Topics:

Compulsory/Recommended Readings:
ADVANCED DBMS 1
PIBA40
Semester: I
Type: Lecture/Labor
Classes/week: 2+2
ECTS Credit points: 4
Prerequisites: PIBA19
Responsible: István Juhász

Topics:

Compulsory/Recommended Readings:

ADVANCED DBMS 2
PIBA41
Semester: I
Type: Lecture/Labor
Classes/week: 2+2
ECTS Credit points: 4
Prerequisites: PIBA40
Responsible: István Juhász

Topics:

Compulsory/Recommended Readings:

SERVER ADMINISTRATION
PIBA42
Semester: I
Type: Labor
Classes/week: 0+2
ECTS Credit points: 2
Prerequisites: PIBA19
Responsible: Béla Almási

Topics:
The target of this labor is to give deep knowledge of administration of current server based information systems (including operating systems and database systems). At the end of the semester the students will be able to perform advanced configuration and tuning tasks on the real systems based on the accurate knowledge of theory and practice.

Compulsory/Recommended Readings:
• Microsoft Official Curriculum - 2151, 2152, 2153; 2071, 2072, 2073.

HIGH SPEED LOCAL- AND METROPOLITAN AREA NETWORKS
PIBA43
Semester: I
Type: Lecture
Classes/week: 2+0
ECTS Credit points: 2
Prerequisites: PIBA19, PIBA29
Responsible: Zoltán Gál

Topics
Networking generations and the different technologies of the generations. Examples and study of current high speed networking technologies. Multipurpose networks (Data, voice, video, fax, etc.) and the integration solution methods.

Compulsory/Recommended Readings:

ACTUAL PROBLEMS OF VOICE AND DATA COMMUNICATION
PIBA44
Semester: I
Type: Lecture
Classes/week: 2+0
ECTS Credit points: 2
Prerequisites: PIBA19, PIBA29
Responsible: Béla Almási
Topics:
The lecture investigates the actual problems of voice and data networking and the most important solutions. E.g.: Voice over IP (VoIP), Quality of Service (QoS), multiprotocol switching and advanced routing technologies, wireless communication.

Compulsory/Recommended Readings:

PERFORMANCE VALUATION OF COMPUTER NETWORKS
PIBA45
Semester: I
Type: Lecture/Labor
Classes/week: 2+2
ECTS Credit Points: 4
Requirements: PIBA13, PIBA19
Responsible: János Sztrik

Topics:

Compulsory/Recommended Readings:
- Daigle J.N.: Queueing Theory for Telecommunications, Addison-Wesley, 1992

COMPUTER GRAPHICS
PIBA46
Semester: I
Type: Lecture/Labor
Classes/week: 2+2
ECTS Credit points: 4
Prerequisites: PIBA17, PIBA19
Responsible: Sándor Bácsó

Topics:
Graphical tools in informatics.
Main fields of the computer graphics (economical, engineering, entertainment).
Problems of 2D (curves, lines, functions, intersections).
Problems of 3D (projections of space, polyhedron models, wire-frame, surface and volumetric models).
Curve surfaces. Visibility issues.

**Compulsory/Recommended Readings:**
- Hoschek J., Lasser D.: Grundlagen der Geometrischen Datenverarbeitung, angolul is megvan.

**GRAPHICAL SYSTEMS**

PIBA47

**Semester:** I  
**Type:** Lecture/Labor  
**Classes/week:** 2+2  
**ECTS Credit points:** 4  
**Prerequisites:** PIBA46  
**Responsible:** Tibor Schwarcz

**Topics:**
Mathematical, geomerial and information background of most actual computer aided design graphical systems. (AutoCAD, CADKEY, GIS, OpenGL) Possible directions of software design.

**Compulsory/Recommended Readings:**
http://www.uni-ak.ac.at/opengeom/  

**GIS**

PIBA48

**Semester:** I  
**Type:** Labor  
**Classes/week:** 0+2  
**ECTS Credit points:** 2  
**Prerequisites:** PIBA17, PIBA19  
**Responsible:** József Szabó

**Topics:**
Overview of representing the real-world in point of view of geographical information systems.  
Grouping of data collection methods, and discussing of its main characteristics. The process of data collection and the quality of data.
Properties of the vector, raster and hybrid data models. Operations of geographical information systems.
Outline of some essential algorithms
Studying, using and developing of current GIS software(s).

Literature:
- User Guides, Manuals of GIS Softwares

MULTIMEDIA
PIBA49
Semester: I
Type: Lecture/Labor
Classes/week: 2+2
ECTS Credit points: 4
Prerequisites: PIBA17, PIBA19
Responsible: Gábor Fazekas

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

Compulsory/Recommended Readings:

INFORMATION THEORY
PIBA50
Semester: I
Type: Lecture
Classes/week: 2+0
ECTS Credit points: 2
Prerequisites: PIBA13, PIBA19
Responsible: Gyula Pap

Topics:
Compulsory/Recommended Readings:


NEURAL NETWORKS
PIBA51

Semester: I
Type: Lecture/Labor
Classes/week: 2+2
ECTS Credit points: 4
Prerequisites: PIBA13, PIBA19
Responsible: István Fazekas

Topics:

Compulsory/Recommended Readings:

COMPUTER STATISTICS 2
PIBA52

Semester: I
Type: Lecture/Computer room
Lesson/week: 2+2
ECTS Credit Points: 4
Prerequisites: PIBA19, PIBA63
Responsible: Márton Ispány

Topics:

Compulsory/Recommended Readings:
OPERATIONS RESEARCH 2
PIBA53

Semester: I
Type: Lecture/Labor
Classes/week: 2+2
ECTS Credit points: 4
Prerequisites: PIBA19, PIBA23
Responsible: Sándor Baran

Topics:
Network models. Blending problem. Modeling for special cases.

Compulsory/Recommended Readings: