Computer Science Engineering MSc

Modern chapters from computer science
Number of Credits: 5
Weekly Hours: 2 lectures, 2 practical lessons, 0 lab.
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 1.
Prerequisites: -
Brief Syllabus
The goal is to provide an insight into various fields of information technology and computational science, which will presumably have practical relevance in the near future. We assume, that the students have gained some preliminary knowledge on various fields of information technology from BA/BSc level, thus the terminology and the fundamental problems are known.

Applied calculus
Number of Credits: 6
Weekly Hours: 3 lectures, 2 practical lessons, 0 lab.
Language of Instructions: English
Grading: Term mark
Place of Subject in Curriculum: 1.
Prerequisites: -
Brief Syllabus
The goal of the course is to provide an introduction to the differential equations arising in fundamental engineering problems and the analytical solution methods of those.

Mathematical modelling
Number of Credits: 5
Weekly Hours: 2 lectures, 2 practical lessons, 0 lab.
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 2.
Prerequisites: -
Brief Syllabus
The most important educational purpose of the course is to get the students know the most frequently used procedures of mathematical programming, have them gain experience in the selection of the applicable methods, usage of software packages, and interpretation of the solutions.

Quantum informatics, cryptography
Number of Credits: 5
Weekly Hours: 2 lectures, 0 practical lessons, 0 lab.
Language of Instructions: English
Grading: Term mark
Place of Subject in Curriculum: 2.
Prerequisites: -
Brief Syllabus
In the course we would like to provide a relatively general overview of the area of quantum information. This goal is mostly motivated by the recent developments of quantum cryptography which are already usable for achieving some cryptographical protocols. Because of this rapid evolution of quantum cryptography and quantum information our students have to be trained in this area too.

Signals and systems
Number of Credits: 5
Weekly Hours: 3 lectures, 1 practical lessons, 0 lab.
Language of Instructions: English
Grading: Term mark
Place of Subject in Curriculum: 2.
Prerequisites: -
Brief Syllabus
The goal of the course is the analysis of the input-output relation of continuous- and discrete-time systems, based on the description of the characteristics and connections of the components and parts.Description of continuous-time and discrete-time signals and component characteristics, analysis of connection constraints of signal-flow networks, solution of the system of equations representing the network.

Engineering practice in the EU 2.
Number of Credits: 2
Weekly Hours: 2 lectures, 0 practical lessons, 0 lab.
Language of Instructions: English
Grading: Term mark
Place of Subject in Curriculum: 3.
Prerequisites: -
Brief Syllabus
The aim of the course is to introduce students to the conditions of practicing the engineering profession, job opportunities and starting an enterprise in EU countries, and to the European engineering associations. Engineers' licenses in the fields of engineering.Working in designer or expert positions.Job opportunities. Business forms in the EU. Establishing a business, legal conditions, taxes.Types of contracts, the main parts of a contract.Fee charging for designer activity.Regulations of tenders and public procurement.European Quality Program (EQP).The establishment, objectives and tasks of the European engineering associations.

Engineering ethics and attitude
Number of Credits: 4
Weekly Hours: 2 lectures, 2 practical lessons, 0 lab.
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 3.
Prerequisites: -
Brief Syllabus
Engineering Ethics and Attitude is designed to introduce engineering graduate students to the concepts, theory and practice of engineering ethics and effective written and oral communications and presentations.The purpose of this course is to help future engineers be prepared for confronting and resolving ethical issues that they might encounter during their professional careers. It gives an overview of the moral problems engineers face in their different social roles, and it provides conceptual tools and methods necessary for pursuing those issues.

Environmental protection for engineers
Number of Credits: 3
Weekly Hours: 2 lectures, 0 practical lessons, 0 lab.
Language of Instructions: English
Grading: Term mark
Place of Subject in Curriculum: 1.
Prerequisites: -
Brief Syllabus
This course aims to give a basic knowledge of environmental processes and environmental protection to engineering student.The lectures cover the following topics: the history of environmental protection; juristical regulation and institution of environmental protection in Hungary; global problems and question of sustainable development; basic concepts; process of pollution; atmosphere and its processes; water protection; land and soil protection; waste treatment and management; noise and vibration; new fields in the environmental protection; renewable energy sources.

Technical quality management
Number of Credits: 2
Weekly Hours: 2 lectures, 0 practical lessons, 0 lab.
Language of Instructions: English
Grading: Term mark
Place of Subject in Curriculum: 2.
Prerequisites: -
Brief Syllabus
This course provides an introduction to quality management.Quality and global competitiveness.Quality management, ethics and social responsibility.Quality Culture.Strategic management.Customer satisfaction, retention and loyalty.Effective communication.Education and training.ISO 9000 and Total Quality.Quality planning, control, improvement and assurance.

Theory of algorithms
Number of Credits: 6
Weekly Hours: 3 lectures, 2 practical lessons, 0 lab.
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 1.
Prerequisites: -

Brief Syllabus
The main goal of the course is to give the students an insight into the algorithms which are most frequently used in practice via teaching them combinatorial, algebraic and graph theoretical algorithms. Besides containing the topics mentioned above, the course implicates the discussions of the basic models and classes furthermore the most important problems in complexity theory too.

Production and process management
Number of Credits: 4
Weekly Hours: 2 lectures, 2 practical lessons, 0 lab.
Language of Instructions: English
Grading: Term mark
Place of Subject in Curriculum: 1.
Prerequisites: -
Brief Syllabus
The course discusses the topic through case studies. Every week at least on Harvard case study is examined, which provides the basis for the discussed subjects. The course focuses on quality management, BPR, product development, and the service sector. Other topics include:Logistics, supply chains, Basic concepts in Stochastic processes, Simple Markovian Queueing Systems, Queueing networks

Diffuse models in image processing
Number of Credits: 4
Weekly Hours: 2 lectures, 2 practical lessons, 0 lab.
Language of Instructions: English
Grading: Term mark
Place of Subject in Curriculum: 1.
Prerequisites: -
Brief Syllabus
This course presents a comprehensive overview of PDE (Partial Differential Equations) based linear and non-linear diffusion models applied in image processing. These models play important role not only in in enhancement of digital images, but preprocess raw images for quantitative analyses. These methods are widely used in machine vision algorithms, both in engineering and medical practice. The students will gain knowledge and skills in topics not ordinarily covered in depth in regular courses and of specific interest to advanced level studies.

Artificial Intelligence
Number of Credits: 4
Weekly Hours: 2 lectures, 2 practical lessons, 0 lab.
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 2.
Prerequisites: -
Brief Syllabus
This course introduces students to basic concepts and methods of artificial intelligence from a computer science perspective. Emphasis of the course will be on the selection of data representations and algorithms useful in the design and implementation of intelligent systems. The course will contain an overview of one AI language and some discussion of important applications of artificial intelligence methodology.

Parallel algorithms and programming
Number of Credits: 4
Weekly Hours: 2 lectures, 2 practical lessons, 0 lab.
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 2.
Prerequisites: -
Brief Syllabus
The aim of the course is to introduce the concept of parallel programming to the students. The course also shows different algorithms that can be used in parallel engineering simulations.Parallel architectures.Memory models. Measurement of the efficiency of algorithms. Parallel algorithm patterns: task parallelism, task farming, geometric decomposition, etc.Finite element mesh generation: Structured and unstructured meshes, advancing front method, Delaunay method, Paving. Parallel mesh generation.

Design and programming of databases
Number of Credits: 5
Weekly Hours: 2 lectures, 2 practical lessons, 0 lab.
Language of Instructions: English

Grading: Exam
Place of Subject in Curriculum: 3.
Prerequisites: -
Brief Syllabus
The course provides a survey of developing methods of different size database application systems. The course shows business objects supporting data and knowledge represent technics and their usage with Java. We shows and use the developing tools of ORACLE and SAP ABAP.

Robotic Systems
Number of Credits: 4
Weekly Hours: 2 lectures, 2 practical lessons, 0 lab.
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 2.
Prerequisites: -
Brief Syllabus
Getting acquaintedwith some important robot application areas and the possibilities of connecting robots into a system – requirements, problems.Short story of robots/industrial robots.Basic concepts and their explanation.Robot applications around the World, in every parts of life.Special (micro, nano) robots, particular applications (e.g. surgery robots).Robot mechanics, robot control, AI in control and operation.Bot programming. Organizational and financial questions, design of robot systems, industrial design, production planning for robot use. Robot cells, robot production systems, integration of robots into mechanical and architectural systems, robots in continuous production, robots in discrete production: welding, assembly, manipulation, disassembly, etc.

Computer vision systems
Number of Credits: 4
Weekly Hours: 2 lectures, 2 practical lessons, 0 lab.
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 3.
Prerequisites: -
Brief Syllabus
The main of this course is to show and investigate the mechanism of human vision, and to introduce computer vision that is based on it. The field of computer vision is an important area of informatics and therefore the students can understand the theoretical and practical basis of this field.Basis of radiometry, filters, photometry and its basis.The mechanism of human vision.Color perception, shape recognition.Combination of colours – color systems. On the basis of this information it is possible to model and implement the automatic, machine vision. Constraints of machine vision.Detectors and measurements.Reproduction of colors.

Intelligent control systems
Number of Credits: 4
Weekly Hours: 2 lectures, 2 practical lessons, 0 lab.
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 3.
Prerequisites: -
Brief Syllabus
The goal of the coarse is to summarize the modern branches of control engineering on the fields of sampled, optimal, predictive and adaptive control systems, and system identification, which presumably will have a long term impact on the theory and practice of robot- and process-control. The application of methods is presented in the frame of typical design tasks of control engineering, using modern equipment. Most of the methods serve the purpose of design multi-variable systems.

Information technology for autonomuous systems
Number of Credits: 4
Weekly Hours: 2 lectures, 2 practical lessons, 0 lab.
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 3.
Prerequisites: -
Brief Syllabus
The aim of the course is to introduce complex engineering and technological systems,their information systems, their requirement, possibilities and application.Introduction to the technological management and information

technology of autonomous systems, Modern paradigms of engineering information management, Technical databases, Knowledgebases, distributed systems, Information technology tools of product development and design, life-cycle engineering, Computer aided process design, computer aided production control, monitoring and control of production, agent based systems, Extended systems, informatics of virtual production, Manufacturing systems in the 21st century, Complexity of manufacturing systems, Knowledge management in manufacturing, Factory of the future, Production Flow – oriented design

Project work
Number of Credits: 4
Weekly Hours: 4 lectures, 0 practical lessons, 0 lab.
Language of Instructions: English
Grading: Term mark
Place of Subject in Curriculum: 3.
Prerequisites: -
Brief Syllabus
During the course the students investigate and solve an engineering problem. The projects are assigned to the individual students and they work on it on their own under the supervision of the lecturer. This course is a preparation for the Diploma work. The diploma work can be a continuation of this course.

Large-scale linear systems of equations
Number of Credits: 4
Weekly Hours: 2 lectures, 2 practical lessons, 0 lab.
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 2.
Prerequisites: -
Brief Syllabus
The aim of the course is to introduce the direct and iterative solvers to students. Furthermore the most modern solution techniques are also discussed, for example: multigrid, domain decomposition.Basic concepts of linear algebra, matrices, discretization of partial differential equations, sparse matrices, iterative solvers, Jacobi, Gauss-Siedel, relaxation methods, Convergence, projection, Krylov method, Arnoldi method, GMRES, Conjugate gradient method, preconditioning, parallel implementations, parallel preconditioning, multigrid methods, Schur complement, domain decomposition

Visualization methods
Number of Credits: 4
Weekly Hours: 2 lectures, 2 practical lessons, 0 lab.
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 3.
Prerequisites: -
Brief Syllabus
The aim of the course is to show and introduce modern and advanced visualization techniques and their application in the scientific field.Visualization cycle.Visualization pipeline and its elements.Data representation.Filtering and data reconstruction.Interpolation.Standard techniques.Volume rendering.Vector and tensor field and their visualization.

Parallel programming techniques
Number of Credits: 4
Weekly Hours: 2 lectures, 2 practical lessons, 0 lab.
Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 3.
Prerequisites: -
Brief Syllabus
In this course the students are introduced to the message passing programming paradigm.Basics of the MPI-Message Passing Interface, Initialization and finishing in MPI, Implementation of basic algorithms, message sending technologies, blocking and non-blocking send, collective communications, Parallel I/O, Dynamic process handling.

Cluster technology, Grid and Cloud computing
Number of Credits: 4
Weekly Hours: 2 lectures, 2 practical lessons, 0 lab.

Language of Instructions: English
Grading: Exam
Place of Subject in Curriculum: 3.
Prerequisites: -
Brief Syllabus
The aim of the course is to discuss the design and implementation of several distributed systems.Classification of distributed systems. Peer-to-peer systems, Napster, Gnutella, Kazaa, BitTorrent, Distributed hash tables and their implementation, Chord, Constant Addressable Network, Cluster computing, Single-system image and its implementation