Course descriptions

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COURSE DESCRIPTION

University: Comenius University in Bratislava	
Faculty: Faculty of Mathematics, Physics and Informatics	
Course ID: FMFI.KAI/2-AIN-127/15	**Course title:** Advanced Computer Graphics

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 28 / 28
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2.

Educational level: II.

Prerequisites:

Antirequisites: FMFI.KAGDM/2-MPG-101/00 and FMFI.KAGDM/2-MPG-102/00

Course requirements:
Attend lessons. One missed +0 points. 2 missed 0 points, 3 missed 0 points, 4 and more is Fx.
Project and exercise (mandatory).
Solve all homework problems (mandatory each one >=30%)
Pass final term (mandatory) You will need to solve several problems discussed during lessons.
Pass oral/written exam: (mandatory)
Scale of assessment (preliminary/final): 60/40

Learning outcomes:
After completing the course students will know techniques of photorealistic computer graphics. Will be able to solve color calculation, shadow computation and render views of a scene from the input images. Students learn the basics of graphical programming in C #.

Class syllabus:
LECTURE01 "INTRODUCTION TO COMPUTER GRAPHICS"
LECTURE02 "RAY TRACING 1."
TayTracong Pipeline
LECTURE03 "RAY TRACING 2."
Ray Intersections
LECTURE04 "RAY TRACING 3."
Ray Tracing Acceleration, Data structure: grids, BVH, Kd-tree, Directional Partitioning, Dynamic Scenes, Beam and Cone Tracing, Packet Tracing
LECTURE05 "LIGHT TRASPORT."
Physics behind ray tracing, Physical light quantities, Visual perception of light, Light sources, Light transport simulation: Rendering Equation
LECTURE06 "RADIOSITY."
Diffuse reflectance function, Radiative equilibrium between emission and absorption, escape, System of linear equations, Iterative solution Neuman series
LECTURE07 "BRDF."
Bidirectional Reflectance Distribution Function (BRDF), Reflection models, Projection onto spherical basis functions, Shading Phong model, Blin-Phong model

Physical BRDF, Ward Reflection Model, Cook-Torrance model
LECTURE08 "SHADOWS."
LECTURE09 "TEXTURING 1, 2."
Texture parameterization, Procedural methods, Procedural textures, Fractal landscapes, Surface reality techniques
LECTURE10 "IMAGE BASED RENDERING 1."
Plenopticfunction, Panoramas, Concentric Mosaics, Light Field Rendering, The Lumigraph
LECTURE11 "IMAGE BASED RENDERING 2."
Layered Depth Images, View-dependent Texture Mapping, Surface Light Fields, View Morphing
LECTURE12 "ASK ME ANYTHING."
Test problem introduction

Recommended literature:

Moderní počítačová grafika / Jiří Žára ... [et al.]. Brno : Computer Press, 2010
Realistic image synthesis using photon mapping / Henrik Wann Jensen ; Foreword by Pat Hanrahan. Natick : A K Peters, 2001
http://www.sccg.sk/~durikovic/classes/CG2/cg2_syllabus.html

Languages necessary to complete the course:
slovak, english

Notes:

Past grade distribution
Total number of evaluated students: 4

A	B	C	D	E	FX
0,0	25,0	75,0	0,0	0,0	0,0

Lecturers: prof. RNDr. Roman Ďurikovič, PhD.

Last change: 22.09.2017

Approved by: prof. RNDr. Roman Ďurikovič, PhD.

COURSE DESCRIPTION

University: Comenius University in Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-112/15	Advanced Image Processing

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 28 / 28
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
homeworks, projects, written exam
A 91%, B 82%, C 73%, D 64%, E 55%
Scale of assessment (preliminary/final): 50/50

Learning outcomes:
Graduates will know the advanced image processing techniques, such as image transformation, filtering, image improvement, advanced segmentation techniques (using active contours - snakes, flood segmentation) etc.

Class syllabus:
Image capture.
Features digital image.
Picture transformation
Methods of image preprocessing, Hough transform
Fourier Transform - DFT, FFT, filters detail
noise Reduction
Mathematical Morphology BW and grayscale
Segmentation. Snake watershed, clustering
improving the image
processing textures

Recommended literature:
Image processing, analysis, and machine vision / Milan Sonka, Vaclav Hlavac, Roger Boyle. [Stamford] : Cengage Learning, 2008
Digital image processing / Rafael C. Gonzalez, Richard E. Woods. Beijing : Pearson education Asia : Publishing House of Electronics Industry, 2010
Image processing : The fundamentals / Maria Petrou, Costas Petrou. Chichester : John Wiley, 2010

Languages necessary to complete the course:

Notes:

Past grade distribution Total number of evaluated students: 32					
A	B	C	D	E	FX
6,25	28,13	43,75	9,38	3,13	9,38
Lecturers: RNDr. Zuzana Černeková, PhD., RNDr. Paula Budzáková					
Last change: 22.09.2017					
Approved by: prof. RNDr. Roman Ďurikovič, PhD.					

COURSE DESCRIPTION

University: Comenius University in Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI+KI/2-AIN-205/15	Algorithmics for Hard Problems

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 28 / 28
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2.

Educational level: II.

Prerequisites:

Recommended prerequisites:
1-AIN-105 Efektívne algoritmy a zložitosť OR 1-INF-310 Tvorba efektívnych algoritmov

Course requirements:
homeworks, quizzes, written exams
Scale: A 90%, B 80%, C 70%, D 60%, E 50
Scale of assessment (preliminary/final): 50/50

Learning outcomes:
After completing this subject students will be able to use the methods to solve difficult algorithmic task, particularly approximation algorithms, probability algorithms and integer linear programming. Students will be able to work with extended methods of analysis algorithms and complexity classes.

Class syllabus:
Introduction to approximation algorithms. Neaproximovateľnosti term. Probabilistic analysis of algorithms and their complexity. Las Vegas and Monte Carlo. Integer linear programming. Overview of a hierarchy of complexity classes. Demonstrations on examples.

Recommended literature:
Introduction to algorithms / Thomas H. Cormen ... [et al.]. Cambridge, Mass. : MIT Press, 2001
Approximation algorithms / Vijay V. Vazirani. Berlin : Springer, 2001
Randomized algorithms / Rajeev Motwani, Prabhakar Raghavan. New York : Cambridge University Press, 1995

Languages necessary to complete the course:
slovensky, anglicky

Notes:

Past grade distribution
Total number of evaluated students: 16

A	B	C	D	E	FX
18,75	18,75	6,25	37,5	18,75	0,0

Lecturers: doc. RNDr. Dana Pardubská, CSc., doc. Mgr. Tomáš Vinař, PhD., RNDr. Jozef Šiška, PhD.
Last change: 22.09.2017
Approved by: prof. RNDr. Roman Ďurikovič, PhD.

COURSE DESCRIPTION

University: Comenius University in Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-137/15	Artificial Intelligence

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 28 / 28
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
projects, written exam
Scale: A 95%, B 88%, C 79%, D 68%, E 55%
Scale of assessment (preliminary/final): 30/70

Learning outcomes:
After completing the course, students should have a good overview of the theoretical methods used in artificial intelligence. They should be able to use these methods in practice in programming intelligent systems, they should be able to enrich and creatively exploit.

Class syllabus:
1. Agents, types of agents, agent properties. Browse - informed strategies. 2. Search - informed strategies. Games. 3. Logical agents, propositional and predicate database knowledge. 4. Inference of the predicate in the knowledge base. 5. Planning. 6. likelihood naive Bayesian classifier, Bayesian network. 7. Bayesian network, exact and approximate inference in Bayesian network. 8. Using Bayesian networks in artificial intelligence. Introduction to the use of probability theory in games. 9. Monte Carlo method in games.
10. The classic theory of time series, time series models. 11. Use of Bayesian networks inference in time series with uncertainty. 12. Markov priocesy, Kalman filter, the use of artificial intelligence. 13. Decision Theory: simple and complex decision-making, decision trees.

Recommended literature:
Artificial intelligence : A modern approach / Stuart J. Russell, Peter Norvig. Englewood Cliffs : Prentice-Hall, 1995
Artificial intelligence a new synthesis / Nils J. Nilsson. San Francisco : Morgan Kaufmann, 1998

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 39

A	B	C	D	E	FX
35,9	15,38	15,38	15,38	15,38	2,56

Lecturers: doc. RNDr. Mária Markošová, PhD.

Last change: 22.09.2017

Approved by: prof. RNDr. Roman Ďurikovič, PhD.

COURSE DESCRIPTION

University: Comenius University in Bratislava	
Faculty: Faculty of Mathematics, Physics and Informatics	
Course ID: FMFI.KAI+KAGDM/2-MPG-125/15	**Course title:** Computer Vision
Educational activities: **Type of activities:** lecture / practicals **Number of hours:** **per week:** 2 / 2 **per level/semester:** 28 / 28 **Form of the course:** on-site learning	
Number of credits: 6	
Recommended semester: 1.	
Educational level: II.	
Prerequisites:	
Course requirements: Assessment: evaluation Preliminary assessment: Continuous assessment projects Final assessment: assessment examination 60% (A 90%; B 80%; C 70%; D 60%; E 50%) Scale of assessment (preliminary/final): 40/60	
Learning outcomes: Graduates will know the advance techniques of machine vision, image recognition and processing, such as feature extraction from images, face detection and tracking, identification of significant areas in the image, etc.	
Class syllabus: Features (low and medium, global, local), extraction. A selection from the database DB. Detection, face tracking. Color gamut mapping. HDR. Eye movement tracking. Significant areas in the image. Image quality.	
Recommended literature: Feature extraction : Foundations and applications / Isabelle Guyon ... [et al.] (eds.). Berlin : Springer, 2006 Algorithms for image processing and computer vision / J. R. Parker. New York : Wiley, 1997 Shape classification and analysis : Theory and practice / Luciano da Fontoura Costa, Roberto Marcondes Cesar, Jr.. Boca Raton, Fla. : CRC Press, 2009 Elena Šikudová, Zuzana Černeková, Vanda Benešová, Zuzana Haladová, Júlia Kučerová: Počítačové videnie. Detekcia a rozpoznávanie objektov, vydavateľstvo Wikina, Praha, ISBN: 978-80-87925-06-5	
Languages necessary to complete the course:	

Slovak and English

Notes:

Past grade distribution
Total number of evaluated students: 46

A	B	C	D	E	FX
13,04	10,87	23,91	23,91	10,87	17,39

Lecturers: Mgr. Ľudovít Balko, PhD., RNDr. Zuzana Berger Haladová, PhD.

Last change: 14.01.2016

Approved by: prof. RNDr. Roman Ďurikovič, PhD.

COURSE DESCRIPTION

University: Comenius University in Bratislava	
Faculty: Faculty of Mathematics, Physics and Informatics	
Course ID: FMFI.KAI/2-AIN-233/00	**Course title:** Computer Vision Applications
Educational activities: **Type of activities:** seminar **Number of hours:** **per week:** 2 **per level/semester:** 28 **Form of the course:** on-site learning	
Number of credits: 3	
Recommended semester: 3.	
Educational level: II.	
Prerequisites:	
Recommended prerequisites: 2-AIN-112/15 or 2-MPG-125/15	
Course requirements: Presentations A 90%, B 80%, C 70%, D 60%, E 50% Scale of assessment (preliminary/final): 100/0	
Learning outcomes: After completing the course students will be able to discover, develop and analyze the latest practices of successful projects in the field of computer vision and apply new trends in computer vision to create their own applications.	
Class syllabus: 1. Case studies of successful applications. 2. Industrial applications. 3. Medical applications. 3. Other applications. 4. Results of departmental research projects. 5. New trends in application of computer vision methods and techniques.	
Recommended literature: Boyle – Šonka – Hlaváč: Image processing, analysis and machine vision, 1999 Research reports ECCV proceedings Internet	
Languages necessary to complete the course:	
Notes:	

Past grade distribution Total number of evaluated students: 152					
A	B	C	D	E	FX
48,03	25,0	9,87	1,97	4,61	10,53
Lecturers: RNDr. Zuzana Černeková, PhD.					
Last change: 23.09.2017					
Approved by: prof. RNDr. Roman Ďurikovič, PhD.					

COURSE DESCRIPTION

University: Comenius University in Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-272/15	Digital Image Processing

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 28 / 28
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
homeworks,
practical exam, written exam, oral exam
Scale: A 88%, B 81%, C 74%, D 67%, E 60%

Learning outcomes:
Students acquire theoretical and practical knowledge with the processing of discrete (sampling analog) one dimensional signals using a computer. The acquired knowledge can be used in real-world applications such as audio processing, measurement sensors, signal transmission ... In the exercises students gain the appropriate skills to work in an environment Octave (freely distributable compatible alternative to Matlab).

Class syllabus:
discrete-time signal
Discrete random signal
Discrete Fourier Transform (DFT)
Okienkový functions and their influence on the properties of the DFT
Z-transformation
Discrete linear time-invariant (LTI) systems
Digital IIR filters
Digital FIR filters
Detection and estimation
Power Spectral Density (PSD)
parametric PSD

Recommended literature:
Springer handbook of speech processing / Jacob Benesty, M. Mohan Sondhi, Yiteng Huang (Eds.). Berlin : Springer, 2008
Číslicová filtrace, analýza a restaurace signálů / Jiří Jan. Brno : Vysoké české učení : VUTIUM, 2002

Languages necessary to complete the course:

Notes:

Past grade distribution Total number of evaluated students: 62					
A	B	C	D	E	FX
24,19	17,74	9,68	12,9	24,19	11,29
Lecturers: RNDr. Marek Nagy, PhD.					
Last change: 23.09.2017					
Approved by: prof. RNDr. Roman Ďurikovič, PhD.					

STATE EXAM DESCRIPTION

University: Comenius University in Bratislava	
Faculty: Faculty of Mathematics, Physics and Informatics	
Course ID: FMFI.KAI/2-AIN-991/15	**Course title:** Diploma Thesis
Number of credits: 16	
Educational level: II.	
Prerequisites: FMFI.KAI/2-AIN-923/15 - Project Seminar (1) and FMFI.KAI/2-AIN-924/15 - Project Seminar (2)	
State exam syllabus:	
Last change: 23.09.2017	
Approved by: prof. RNDr. Roman Ďurikovič, PhD.	

COURSE DESCRIPTION

University: Comenius University in Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI+KAGDM/2-AIN-138/16	Discrete Structures in Informatics and Computer Graphics

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 28 / 28
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 12

A	B	C	D	E	FX
8,33	16,67	16,67	16,67	33,33	8,33

Lecturers: doc. RNDr. Tatiana Jajcayová, PhD., doc. RNDr. Róbert Jajcay, DrSc.

Last change: 22.09.2017

Approved by: prof. RNDr. Roman Ďurikovič, PhD.

COURSE DESCRIPTION

University: Comenius University in Bratislava	
Faculty: Faculty of Mathematics, Physics and Informatics	
Course ID: FMFI.KAI/2-AIN-134/14	**Course title:** Geometric modelling in graphics
Educational activities: **Type of activities:** lecture / practicals **Number of hours:** **per week:** 2 / 2 **per level/semester:** 28 / 28 **Form of the course:** on-site learning	
Number of credits: 6	
Recommended semester: 2.	
Educational level: II.	
Prerequisites:	
Course requirements: Projects, oral exam A 90%, B 80%, C 70%, D 60%, E 50% Scale of assessment (preliminary/final): 50/50	
Learning outcomes: After completing the course, students will be able to distinguish between the current methods and options for creating, modeling and digital representation of three-dimensional objects. He will be able to implement these structures and procedures to use and modify them under the existing modeling tools.	
Class syllabus: 1. Polygonal networks - describes the structure for polygonal representation networks, simplification, smoothing compression and networking, computing over networks (earth, normal, curvature), parameterization and triangularizácia, interactive techniques for modeling networks 2. Parametric curves and surfaces - polynomial and spline representation, design and modeling, tessellation, redistribution curves and surfaces 3. implicit FREP a volumetric representation - classification, modeling, set operations, conversion to the polygonal network 4. point clouds - representation of unorganized set of points, nearest neighbor search set of points, proximity graphs, surface reconstruction, multiview geometry 5. Procedural modeling - L-systems, generating terrain procedurally buildings and cities	
Recommended literature: Curves and Surfaces for computer-Aided geometric design : A practical Guide / Gerald E. Farin. San Diego : Academic Press, 1997	
Languages necessary to complete the course:	
Notes:	

Past grade distribution Total number of evaluated students: 5					
A	B	C	D	E	FX
0,0	20,0	40,0	20,0	0,0	20,0
Lecturers: prof. RNDr. Roman Ďurikovič, PhD.					
Last change: 22.09.2017					
Approved by: prof. RNDr. Roman Ďurikovič, PhD.					

STATE EXAM DESCRIPTION

University: Comenius University in Bratislava	
Faculty: Faculty of Mathematics, Physics and Informatics	
Course ID: FMFI.KAI/2-AIN-953/15	**Course title:** Methods of Applied Informatics
Number of credits: 4	
Educational level: II.	
State exam syllabus:	
Last change: 23.09.2017	
Approved by: prof. RNDr. Roman Ďurikovič, PhD.	

COURSE DESCRIPTION

University: Comenius University in Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-132/15	Neural Networks

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 28 / 28
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2.

Educational level: II.

Prerequisites:

Antirequisites: FMFI.KAI/1-AIN-480/00

Course requirements:
individual projects, written and oral exam
Scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 60/40

Learning outcomes:
After completing the course will student understands the basic principles of connectionism (neural networks) know the basic models of neural networks and know their usefulness when solving various tasks (eg. Pattern recognition, classification, time series prediction, memorizing patterns and others). Lectures are combined with computer simulations exercises in Matlab.

Class syllabus:
Introduction to artificial neural networks (NS), NS logical neurons. The digital / analog Perceptron: the concept of learning with a teacher pattern recognition.
Linear NS: vector spaces, autoassociative memory. Multi-layer perceptron: the method of back propagation error, training and test set, generalization, selection of model validation. Hebbovské learning without a teacher, feature extraction, principal component analysis. Learning the competition, self-organizing map clustering, topographic display. Hybrid NS: radial-basis-function NS algorithm for training, properties. Recurrent NS: temporal structure in data, models and algorithms for training, echo state networks, recurrent self-organizing maps. Hopfield model: deterministic and stochastic dynamics, attractors in state space, autoassociative memory. Deep architecture NS.

Recommended literature:
Neural networks and learning machines / Simon Haykin. Upper Saddle River : Pearson education, 2009
Úvod do teórie neurónových sietí / Vladimír Kvasnička ... [et al.]. Bratislava : Iris, 1997
Neural networks (slajdy k prednáškam), Igor Farkaš, Knižničné a edičné centrum FMFI UK v Bratislave, 2011.

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 51

A	B	C	D	E	FX
31,37	7,84	11,76	13,73	11,76	23,53

Lecturers: prof. Ing. Igor Farkaš, Dr.

Last change: 22.09.2017

Approved by: prof. RNDr. Roman Ďurikovič, PhD.

COURSE DESCRIPTION

University: Comenius University in Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-204/10	Pattern Recognition

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 28 / 28
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
tests, projects, oral exam
Scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 40/60

Learning outcomes:
Graduates will acquire basic methods of classification.

Class syllabus:
The role of classification, feature articles and Syntax Notation.
Selection and pretreatment symptoms.
Classifiers, basic concepts.
Bayesian decision theory, discriminatory and divisive functions hypersurface, the criterion of the minimum error.
Decision trees.
Discriminant analysis, linear classifier.
Mechanisms of support vectors (SVM).
Neural networks.
Uncontrolled classifiers.
Hidden Markov models.
Quality rating classification.
Syntactic recognition, inference grammar. Special types of grammar.

Recommended literature:
Pattern classification / Richard O. Duda, Peter E. Hart, David G. Stork. New York : Wiley Interscience, 2001
Classification pattern recognition and reduction of dimensionality / edited by P. R. Krishnaiah, L. N. Kanal. Amsterdam : North-Holland, 1982
Modern multivariate statistical techniques : Regression, classification, and manifold learning / Alan Julian Izenman. New York : Springer, 2008

Languages necessary to complete the course:

Notes:

Past grade distribution Total number of evaluated students: 137					
A	B	C	D	E	FX
8,76	17,52	27,74	21,9	12,41	11,68
Lecturers: doc. RNDr. Milan Ftáčnik, CSc., RNDr. Zuzana Berger Haladová, PhD.					
Last change: 22.09.2017					
Approved by: prof. RNDr. Roman Ďurikovič, PhD.					

COURSE DESCRIPTION

University: Comenius University in Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-206/15	Physical-based Animations and Mathematical Modeling

Educational activities:
Type of activities: lecture / independent work
Number of hours:
per week: 2 / 2 **per level/semester:** 28 / 28
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Evaluation: assignments, homeworks, written exams, computer animation project or programming project from physically based animation of natural phenomena
Exam: final exam, project presentation, oral exam
Evaluation scale: A 92%, B 84%, C 76%, D 68%, E 60%
Scale of assessment (preliminary/final): 40/60

Learning outcomes:
Students will learn the basic techniques of simulation particle systems, solving systems of ordinary differential equations numerically, the object collision detection. Understand the principles of dynamics of rigid bodies and the principle of the creation of computer animation and camera movement. Understand how to construct physics engine for games or video animation.

Class syllabus:
Particle systems, motion equations of first order integration methods to calculate the speed and position, state vector system, external forces, restrictive conditions - constraints, response forces, particle collisions - plane.
Numerical solution of differential equations, Euler method, Runge-Kuta method, stability criteria to select the time step.
Lagrange method without networks, modeling and animation point cloud, SPH, deformation
Animation mobility, spline interpolation to animate movement, reparametrisation spline curves by length, and orientation quaternion interpolation of two or more quaternion.
Collision detection, Z buffer algorithm, necessary and sufficient conditions when there are two bodies in a collision, parting line, hierarchy envelopes force response (Response Forces). Three phase detection wide, medium and narrow.
Dynamics of rigid bodies, equations of motion, velocity, acceleration, angular velocity and angular acceleration, inertia matrix.
Procedurárne animation, systems and methods for creating computer animation liquids, fire, smoke.
Computer animation in games and in the film industry. Other applications of computer animation with further developments in the field of computer animation using physical effects.

Recommended literature:

Visual Quantum mechanics : Selected Topics with Computer/Generated animations of Quantum-Mechanical phenomena / Bernd Thaller. New York : Springer, 2000
Computer facial animation / Frederic I. Parke, Keith Waters. Wellesley : A. K. Peters , 1996
SIGGRAPH tutorialy dostupné na http://dl.acm.org/dl.cfm?CFID=412417535&CFTOKEN=50913605
Dostupné texty k prednáške. https://dai.fmph.uniba.sk/w/Physical-based_Animations_and_Mathematical_Modeling_Material

Languages necessary to complete the course:
english

Notes:

Past grade distribution
Total number of evaluated students: 187

A	B	C	D	E	FX
45,45	18,18	10,7	8,02	6,95	10,7

Lecturers: prof. RNDr. Roman Ďurikovič, PhD.

Last change: 22.09.2017

Approved by: prof. RNDr. Roman Ďurikovič, PhD.

COURSE DESCRIPTION

University: Comenius University in Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-109/15	Programming of Parallel and Distributed Systems

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 3 / 1 **per level/semester:** 42 / 14
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
excercises, exam
A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 40/60

Learning outcomes:
Graduates of the course will be familiar with the issues of parallel and distributed programming. At the beginning they learn the means of writing parallel and distributed programs as necessary logic to evidence and formulate their properties. Later they learn the solution of selected problems in parallel and distributed programming (eg. The shortest path problem Reader-Writers, Večerajúci philosophers, coordination meetings, drinkers philosophers, sorting, Faulty channels, Global snapshots, detected a stable qualities, Byzantine Agreement).

Class syllabus:
Initially, the students met a simple language for writing parallel programs and dostribuovaných. UNITY (syntax and semantics) Fundamental parallel and distributed architectures as a way for them to map UNITY programs. The list is the logic of allowing express safetty and progress vlastnostio programs and formally prove the correctness of programs. Subsequently they learn the solution of selected problems in parallel and distributed programming (eg. The shortest way, reader-writers problem dinning philosophers, coordination meetings, drinkers philosophers, sorting, Faulty channels, Global snapshots, detected a stable qualities, Byzantine Agreement). Their zones can optionally be spread in závoslosti the development in this area.

Recommended literature:
Parallel program design : A Foundation / K. Mani Chandy , Jayadev Misra. Reading : Addison-Wesley, 1988
An introduction to parallel algorithms / Joseph Jájá. Boston : Addison-Wesley, 1992
C. Stirling: Modal and Temporal Properties of Processes, Springer 2001
Elektronické poznámky k prednáške, http://ii.fmph.uniba.sk/~gruska/udpp/Beziacaudppprednaska2014.pdf

Languages necessary to complete the course:
slovak, english

Notes:

Past grade distribution
Total number of evaluated students: 98

A	B	C	D	E	FX
14,29	14,29	24,49	29,59	10,2	7,14

Lecturers: doc. RNDr. Damas Gruska, PhD.

Last change: 13.01.2016

Approved by: prof. RNDr. Roman Ďurikovič, PhD.

COURSE DESCRIPTION

University: Comenius University in Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-923/15	Project Seminar (1)

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 28
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Evaluation of the diploma thesis progress
1. Presentation, 2. First prototype implemented, 3. Research papers studied and the detail knowledge of the the problem is required. 4. Framework for development of the thesis should be already set.
A 92%, B 84%, C 76%, D 68%, E 60%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Learning to quickly extract the basic idea of scientific articles.

Class syllabus:
The first phase of the project master thesis. Conventions for writing professional texts informatics. Work on the project and implementation so that results in the diploma thesis.

Recommended literature:
LATEX : Podrobný průvodce / Helmut Kopka, Patrick W. Daly ; překlad Jan Gregor. Brno : Computer Press, 2004
LATEX : A Document preparation system / Leslie Lamport. Reading : Addison-Wesley, 1986

Languages necessary to complete the course:
slovak, english

Notes:

Past grade distribution
Total number of evaluated students: 128

A	B	C	D	E	FX
56,25	14,84	14,06	3,13	2,34	9,38

Lecturers: prof. RNDr. Roman Ďurikovič, PhD.

Last change: 23.09.2017

Approved by: prof. RNDr. Roman Ďurikovič, PhD.

COURSE DESCRIPTION

University: Comenius University in Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-924/15	Project Seminar (2)

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 28
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 3.

Educational level: II.

Prerequisites: FMFI.KAI/2-AIN-923/15 - Project Seminar (1)

Recommended prerequisites:
2-AIN-924 Projektový seminár (1)

Course requirements:
Evaluation of the diploma thesis progress
1. Presentation, 2. First prototype implemented, 3. Research papers studied and the detail knowledge of the the problem is required. 4. Framework for development of the thesis should be already set. 5. Ano chapter of the thesis should be in its final stage.
All requirements must be satisfactory completed.
A 92%, B 84%, C 76%, D 68%, E 60%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Theoretical background of the thesis will be known and the implementation flips to its final stage of evaluation.

Class syllabus:

Recommended literature:
LATEX : Podrobný průvodce / Helmut Kopka, Patrick W. Daly ; překlad Jan Gregor. Brno : Computer Press, 2004
LATEX : A Document preparation system / Leslie Lamport. Reading : Addison-Wesley, 1986

Languages necessary to complete the course:
slovensky, anglicky

Notes:

Past grade distribution
Total number of evaluated students: 136

A	B	C	D	E	FX
55,15	13,24	10,29	4,41	8,09	8,82

Lecturers: prof. RNDr. Roman Ďurikovič, PhD.

Last change: 23.09.2017
Approved by: prof. RNDr. Roman Ďurikovič, PhD.

COURSE DESCRIPTION

University: Comenius University in Bratislava	
Faculty: Faculty of Mathematics, Physics and Informatics	
Course ID: FMFI.KAI/2-AIN-128/15	**Course title:** Real-time Graphics and GPU Computations

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 28 / 28
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2.

Educational level: II.

Prerequisites:

Antirequisites: FMFI.KAGDM/2-MPG-101/00 and FMFI.KAGDM/2-MPG-102/00

Course requirements:
project, oral exam
Scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 70/30

Learning outcomes:
The course represents the key themes, principles and techniques used in the rendering of virtual scenes in real time. This procedure is most commonly used in making 3D games, but also in various scientific vizualizations, such as visualization of medical data. After the course the students will be able to analyze and implement current procedures, algorithms, programming effects for graphics cards and the create the visualization applications. The subjects students will be able to develop gaming applications on different platforms, applications in virtual and mixed reality and create visualizations of medical data.

Class syllabus:
1. Graphic display channel - description of the graphics hardware architectures, programming of graphics cards, coordinate systems, programmable parts of the display channel, description and formats of virtual scene during the rendering, OpenGL API
2. Animation - a description of the object pose representation (position, rotation, scale), nuts and Quaternions, linear and cubic interpolation for animation
3. Light - description of lighting models and their implementation using shaders, textures in lighting model, direct and defferred lighting, use rendering to texture and shadows, approximation of global illumination methods
4. Post-process Effects - description of algorithms to improve the quality of the final output image, motion blur, depth of field, SSAO, reflections and refractions, HDRI, bloom, toon shading
5. Image-based rendering - use of texture to speed up calculations of lighting, textures for backgrounds to represent complex objects (bilboarding), image processing algorithms on the GPU, volumetric graphics
6. Accelerating algorithms - algorithms and structures to accelerate rendering complex scenes, trimming techniques, level of detail, collision detection

7. GPGPU - description of the graphics card performance for general computing, CUDA and OpenCL language, image and video processing, physical simulation of phenomena on the GPU, ray tracing on the GPU

Recommended literature:
Real-time rendering / Tomas Akenine-Möller, Eric Haines, Naty Hoffman. Wellesley : A. K. Peters, 2008

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 8

A	B	C	D	E	FX
37,5	37,5	0,0	0,0	0,0	25,0

Lecturers: Mgr. Andrej Mihálik, PhD.

Last change: 14.01.2016

Approved by: prof. RNDr. Roman Ďurikovič, PhD.