Course descriptions

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COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-148/22	3D Vision

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Homework assignments, projects, oral examination
Scale: A 90%, B 80%, C 70%, D 60%, E 50%
Weight of the course work / exam: 50/50
Scale of assessment (preliminary/final): 50/50

Learning outcomes:
Graduates will acquire basic methods of classification.

Class syllabus:
Mathematics - vector spaces, matrax representation of groups (GL, SL, O, SO, A, E, SE), matrix properties, SVD
Single-view geometry - image projection, intrinsic camera parameters, image transformations, images of points and lines, vanishing points, camera calibration
Two-view geometry - epipoles, fundamental and essential matrix, special cases of motion, degenerate configurations, homographies, 7-point algorithm, 8-point algorithm, scene reconstruction
Multiple-view geometry - registration, scene reconstruction, ICP, SLAM
Advanced non-linear optimization - Levenberg-Marquardt, bundle adjustment
Robust estimation algorithms - RANSAC and its variants (MLESAC, PROSAC, USAC, GC-RANSAC, MAGSAC++), kernel voting, methods based on median
Minimal problems - formulation, solutions, automatic solvers, computer algebra
Differentiable and hybrid approaches - deep learning, loss functions, networks equivariant to input permutation, 6D object pose detection, depth estimation

Recommended literature:
Ma, Yi, et al. An invitation to 3-d vision: from images to geometric models. New York: Springer, 2004.
Hartley, Richard and Zisserman, Andrew. Multiple View Geometry in Computer Vision. 2 New York: Cambridge University Press, 2003.

Durrant-Whyte, Hugh, and Tim Bailey. "Simultaneous localization and mapping: part I." IEEE robotics & automation magazine 13.2 (2006): 99-110.
Chang, Will, et al. "Computing correspondences in geometric data sets. Eurographics Tutorial" (2011).
Larsson, Viktor, Kalle Astrom, and Magnus Oskarsson. "Efficient solvers for minimal problems by syzygy-based reduction." Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition. 2017.
“RANSAC in 2020, CVPR Workshop,” 2020. [Online]. Available: http://cmp.felk.cvut.cz/cvpr2020-ransac-tutorial/

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 13

A	B	C	D	E	FX
38,46	7,69	30,77	0,0	23,08	0,0

Lecturers: Ing. Viktor Kocur, PhD.

Last change: 16.11.2021

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

COURSE DESCRIPTION

Academic year: 2026/2027	
University: Comenius University 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:** 26 / 26 **Form of the course:** on-site learning	
Number of credits: 6	
Recommended semester: 2.	
Educational level: II.	
Prerequisites:	
Antirequisites: FMFI.KAG/2-MPG-101/00 and FMFI.KAG/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) For the semester, the student can get 50% for exercises, 10% bonus, 10% for homework, the final exam consists of a test with weights of 20% and the oral exam is for 20%. The student must solve at least 30% of each homework in order to pass the final written exam. Grading: 92-100 A, 84-91 B, 76-83 C, 68-75 D, 60-67 E. Details on the subject page. 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: 18

A	B	C	D	E	FX
27,78	16,67	27,78	5,56	11,11	11,11

Lecturers: prof. RNDr. Roman Ďurikovič, PhD., Mgr. Andrej Mihálik, PhD.

Last change: 20.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University 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:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
It is necessary to obtain at least 90% of the points to obtain A grade, at least 80% of points to grade B, at least 70% of points to grade C, at least 60% to grade D and at least 50% to grade E.
The course assessment consists of three parts: exercises (30%), project (20%) and final exam (50%). Students should get at least 30 points (out of 50) from exercises and project to meet the minimum condition for admission to the final written exam.
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:
Computer Vision: Algorithms and Applications, Richard Szeliski, The University of Washington, 2nd ed. 2021
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; 4th edition, 2018
Image processing : The fundamentals / Maria Petrou, Costas Petrou. Chichester : John Wiley, 2010

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 108

A	B	C	D	E	FX
11,11	24,07	32,41	12,96	3,7	15,74

Lecturers: doc. RNDr. Zuzana Černeková, PhD., Ing. Viktor Kocur, PhD.

Last change: 23.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-131/24	Advanced programming in JAVA (JakartaEE)

Educational activities:
Type of activities: course
Number of hours:
per week: 4 **per level/semester:** 52
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2.

Educational level: II.

Prerequisites:

Recommended prerequisites:
1-AIN-172 Programovanie (4)

Course requirements:
During semester: Exercises and mini projects
Exam: projects
Scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 60/40

Learning outcomes:
Students will get oriented in advanced technologies of Java and JakartaEE: XML and JSON processing, programming, network applications, access to relational databases, mail, security, Servlets, JSF, websocket, JPA, JMS, batch, object-relational mapping, web services SOAP and REST, web applications in Java.

Class syllabus:
- technologies XML and JSON
- client/server networking, master/slave
- java.nio
- relational databases from Java
- simple encryption and signing
- Servlets
- JSF
- Websocket
- JPA
- JMS
- batch
- JAXWS, JAXRS
- web applications in Java

Recommended literature:
Java EE 8 Tutorial

JAVA EE 7 wtih GlassFish 4 Application Server (David Heffelfinger), Packt Publishing 2014
Java EE 7 Essentials (Arun Gupta), O'Reily, 2013
The Java EE 7 Tutorial, vol1, vol2 (Eric Jendrock, Ricardo Cervera-Navarro, Ian Evans, Kim Haase, William Markito), Oracle, 2014
Java a XML pro Javu 5 i 6 (Pavel Herout), v knižnici
Sun Certified Enterprise Architect for Java EE, Study Guide, 2nd ed. (Mark Cade, Humphrey Sheil)

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 11

A	B	C	D	E	FX
45,45	0,0	27,27	9,09	9,09	9,09

Lecturers: doc. Mgr. Yevheniia Kataieva, PhD., RNDr. Peter Borovanský, PhD., prof. RNDr. Zuzana Kubincová, PhD.

Last change: 28.05.2024

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-156/22	Agile Software Development in Teams

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 1 / 3 **per level/semester:** 13 / 39
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 1., 3.

Educational level: II.

Prerequisites:

Course requirements:
Interim evaluation: activity and presentation of intermediate results
Examination: written or oral examination, presentation and defense of the results of a joint project
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 40/60

Learning outcomes:
The aim of the course is to gain practical experience in team software system development. Within the course, students will also deepen their knowledge of UML and systems design. After this course, students will be able to better lead people and projects, work together in a team, estimate project progress and impending problems, and optimize the software development process.

Class syllabus:
1. Agile development and SCRUM, working with GitHub and Jira
2. DevOps, software project management (Pert, CPM, Gantt, COCOMO)
3. Intensive modeling in UML and TOGAF
4. Creating effective use cases
5. Systems design, architectural styles and patterns, analytical and design patterns
6. Refactoring
7. Creating applications in 3D space, virtual and augmented reality
8. Risk management, software metrics, software quality, ISO for software engineering, interface quality and overall functionality, UX evaluation
9. Quality of program code, defensive programming and testing
10. Deployment and operation of distributed and web applications

Exercises:
Agreed project topics will be solved in teams of about 4 students according to the methodology of Agile Development and SCRUM.

Recommended literature:
1. Sutherland, J., Coplien, J.: A Scrum Book: The Spirit of the Game. Pragmatic Programmers, O'Reilly. 2019

2. Davis J., Daniels R.: Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale, O'Reilly, 2016
3. Desfray P., Raymond G.: Modeling Enterprise Architecture with TOGAF, O'Reilly, 2014
4. Coplien O. J., Bjornvig G.: Lean Architecture for Agile Software Development. J. Wiley, 2014.
5. Cockburn A., Writing Effective Use Cases. Addison-Wesley, 2000.
6. Arlow J., Neustadt I. UML 2 and the Unified Process: Practical Object-Oriented Analysis and Design. Addison-Wesley, 2006.
7. Kerievsky J.: Refactoring to Patterns. Addison Wesley, 2008.
8. Fowler M.: Refactoring. Improving the Design of Existing Code. Wesley Longmann, 2000.
9. Pugh K.: Prefactoring, O'Reilly, 2005
10. Buschmann F. et al.: Pattern-oriented software architecture: a pattern language for distributed computing, Vol. 4. New York : John Wiley & Sons, 2007.

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 125

A	B	C	D	E	FX
18,4	32,0	32,0	8,0	2,4	7,2

Lecturers: doc. Ing. Ivan Polášek, PhD.

Last change: 27.11.2021

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University 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:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2.

Educational level: II.

Prerequisites:

Recommended prerequisites:
1-AIN-105 Efficient algorithms and compexity OR 1-INF-310 Design of efficient algorithms

Course requirements:
homeworks (28%), midterm (22%), written exam and oral consultation (50%)
To pass the exam, student has to achieve at least 50% on the exam.
Scale: 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 use methods for solving hard algorithmic tasks, particularly approximation algorithms, probabilistic algorithms, and integer linear programming. Students will be able to work with advanced methods for analysis of algorithms.

Class syllabus:
Introduction to approximation algorithms. Inapproximability. Probabilistic algorithms and their complexity. Las Vegas and Monte Carlo. Integer linear programming. Hierarchy of complexity classes. 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:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 80

A	B	C	D	E	FX
23,75	12,5	16,25	20,0	17,5	10,0

Lecturers: doc. Mgr. Tomáš Vinař, PhD., RNDr. Jozef Šiška, PhD.

Last change: 24.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-235/22	Algorithms of Artificial Intelligence in Robotics

Educational activities:
Type of activities: lecture / laboratory practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 5

Recommended semester: 4.

Educational level: II.

Prerequisites:

Course requirements:
Continuous assessment: exercises 30%, project 30%
Exam: final test 40%
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 50/50

Learning outcomes:
Students will understand methods of Artificial Intelligence that are useful for intelligent robotic systems. They will have a practical hands-on experience with programming real and simulated robotic intelligent systems.

Class syllabus:
Perception and sensor systems, software robotic architectures, space representation and inference, navigation and localization, probabilistic approaches, simulation, artificial life evolutionary algorithms and neural networks in robotics, applications.

Recommended literature:
The robotics primer / Maja J. Matarić. Cambridge, Mass. : MIT Press, 2007
Invitation to topological robotics / Michael Farber. Zürich : European Mathematical Society, 2008

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 30

A	B	C	D	E	FX
20,0	33,33	36,67	6,67	0,0	3,33

Lecturers: Mgr. Pavel Petrovič, PhD., prof. Ing. Igor Farkaš, Dr.

Last change: 15.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-140/20	Architectures of Software Systems

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2.

Educational level: II.

Prerequisites: FMFI.KAI/2-AIN-156/22 - Agile Software Development in Teams

Course requirements:
Continuous assessment: midterm
Examination: oral or written examination
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 40/60

Learning outcomes:
Deeper knowledge of software engineering, architectural styles and patterns, design patterns, creating models and modeling the architectures. After this course students will be able to study and implement styles and patterns, use prefactoring and refactoring to optimize software design.

Class syllabus:
Stručná osnova predmetu:
1. Architectural styles I. (Garlan & Shaw: Abstract Machine, Pipes and Filters, Client-Server, Object Model, Repository, Blackboard)
2. Architectural styles II. (Interpreter, Modern Canonical Compiler, Rule-Based System, Aspect Oriented Architectures, MVC, Mickrokernel)
3. Distributed architectures, CORBA, Service Oriented Architectures.
4. Architectural patterns I (Buschmann: POSA IV: Pattern Oriented Software Architecture for Distributed Computing).
5. Architectural patterns II. (Reactor, Proactor, Requestor, Invoker, Acceptor, Connector, ACT, Facade, Master-Slave, ...)
6. Architectural patterns III (Memento, Context Object, DTO, Adapter, Iterator, Interceptor, ...)
7. Design patterns I (model and source code level, Gamma et al.).
Creational Patterns (Builder, Abstract Factory, Factory method, ...).
8. Design patterns II. Structural Patterns (Bridge, Decorator, Composite, Proxy, ...)
9. Design patterns III. Behavioral Patterns. (Command, Mediator, State, Strategy, Visitor, Observer, ...)
10. From Refactoring to Patterns (Kerievsky).
11. Refactoring and Prefactoring (Fowler, Pugh).

12. UML and its new features. Superstructure, Infrastructure, meta-models, and Object Constraint Language. Consistency and interconnection of models. XMI, HUTN and PlantUML. 3DUML and xDUML.
13. Agile Modeling and development process. Lean Architecture (Coplien).

Recommended literature:

1. Buschmann F. et al.: Pattern-oriented software architecture: a pattern language for distributed computing, Vol. 4. New York : John Wiley & Sons, 2007. BUSCHMANN, F. -- HENNEY, K. -- SCHMIDT, D. Pattern-oriented software architecture: a pattern language for distributed computing, vol. 4. New York : John Wiley & Sons, 2007.
2. Shaw M L., Garlan D.: Software architecture: Perspectives on an emerging discipline. Prentice Hall, 1996. SHAW, M L. -- GARLAN, D. Software architecture: Perspectives on an emerging discipline.
Upper Saddle River : Prentice Hall, 1996.
3. Arlow J., Neustadt I. UML 2 and the Unified Process: Practical Object-Oriented Analysis and Design. Addison-Wesley, 2006.
4. Kerievsky J.: Refactoring to Patterns. Addison Wesley, 2008.
5. Gamma E. et al.: Design Patterns. Elements of Reusable Object-Oriented Software. Addison Wesley, 1994.
6. Fowler M.: Refactoring. Improving the Design of Existing Code. Wesley Longmann, 2000.
7. Pugh K.: Prefactoring, O'Reilly, 2005
8. Coplien O. J., Bjornvig G.: Lean Architecture for Agile Software Development. J. Wiley, 2014.
9.
SOMMERVILLE, I. Software engineering. Harlow : Pearson Education Limited, 2004.
ARLOW, J. -- NEUSTADT, I. UML 2 and the Unified Process: Practical Object-Oriented Analysis and Design. New Jersey : Addison-Wesley, 2006. 592 p. ISBN 0-321-32127-8.KERIEVSKY, J. Refactoring to Patterns. Boston: Addison Wesley, 2008.
GAMMA, E. -- HELM, R. -- JOHNSON, R. -- VLISSIDES, J. Design Patterns. Elements of Reusable Object-Oriented Software. Boston : Addison Wesley, 1994. 395 p. ISBN 0-201-63361-2.
FOWLER, M. Refactoring. Improving the Design of Existing Code. Boston: Wesley Longmann, 2000.
Pugh K.:Prefactoring, O'Reilly, 2005

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 81

A	B	C	D	E	FX
27,16	33,33	23,46	4,94	0,0	11,11

Lecturers: doc. Ing. Ivan Polášek, PhD.

Last change: 18.11.2021

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-MXX-133/23	Artificial Intelligence for Everyone

Educational activities:
Type of activities: training session / course
Number of hours:
per week: 9 **per level/semester:** 1t / 117
Form of the course: on-site learning

Number of credits: 6

Recommended semester:

Educational level: I.II., 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: 22

A	B	C	D	E	FX
45,45	36,36	4,55	9,09	4,55	0,0

Lecturers: prof. Ing. Igor Farkaš, Dr.

Last change:

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-150/24	Cloud-native App Development

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2., 4.

Educational level: II.

Prerequisites:

Recommended prerequisites:
It is recommended but not required to complete 2-AIN-275/22 Development of Large Software Applications.

Course requirements:
Continuous assessment: midterm
Examination: oral or written examination
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 40/60

Learning outcomes:
The aim of the course is for students to:
1. Understand the principles of native cloud applications
2. They learned the principles of containerization of applications
3. They learned the principles of micro-services and their integration
4.They learned principles of serverless programming in cloud
5. They learned the principles of data streaming
6. Gain an overview of basic cloud services (for example, Amazon AWS)
7. They gained practical experience with selected technologies for containerization, micro services, data streaming and serverless programming in cloud..

Class syllabus:
Brief syllabus of lectures:
1. Principles of cloud-native applications.
2. Microservices.
3. Containerization (Docker/Podman).
4. Container orchestration (Kubernetes).
5. Java for cloud-native applications (MicroProfile, SpringBoot, Quarkus).
6. Patterns for micro services and cloud-native applications.
7. Basic overview of services in Amazon AWS Cloud
8. Serverless programming in AWS cloud

9. Data streaming.
10. MLOps and cloud
Exercise topics:
1. SpringBoot
2. Docker/Podman
3. Kubernetes
4. Quarkus
5. Amazon AWS EC2
6. Amazon AWS API Gateway, AWS Lambda
7. KAFKA

Recommended literature:

Indrasiri, K., Suhothayan, S.: Design patterns for cloud native applications. O'Reilly 2021.
Kralj, M.: Road the Cloud-Native Era: More than just Datacenters in the Sky. OpenSlava 2018.
Burns, B., Beda, J., Hightower, K.: Kubernetes: Up and Running, 2nd edition. O'Reilly. 2019.
Clingan, J., Finnigan, K.: Kubernetes Native Microservices with Quarkus and MicroProfile. Manning Publications 2021.
Richardson, R.: Microservices Patterns: With Examples in Java. Manning Publications 2019.
Tiež na: https://microservices.io/
Gammelgaard, C. H.: Microservices in .NET, Second Edition. Manning Publications 2021.
Freeman, A.: Pro ASP.NET Core 3. Develop Cloud-Ready Web Applications Using MVC, Blazor,
and Razor Pages. 8th Edition. Apress 2020.
Spring Boot: https://docs.spring.io/spring-boot/docs/current/reference/htmlsingle/
Spring Cloud: https://docs.spring.io/spring-cloud/docs/current/reference/html/
Kubernetes: https://kubernetes.io
MicroProfile: https://microprofile.io/
Amazon AWS: https://aws.amazon.com/products/
Amazon AWS Architecture center: https://aws.amazon.com/architecture/
Microsoft Azure Architecture Center: https://docs.microsoft.com/en-us/azure/architecture/
Microsoft Azure Portal: https://azure.microsoft.com/en-us/features/azure-portal/
Stopford, B.: The Data Dichotomy: Rethinking the Way We Treat Data and Services. https://www.confluent.io/blog/data-dichotomy-rethinking-the-way-we-treat-data-and-services/
What every software engineer should know about real-time data's unifying abstraction - https://engineering.linkedin.com/distributed-systems/log-what-every-software-engineer-should-know-about-real-time-datas-unifying
https://kafka.apache.org/documentation/
Kreuzberger, D., Kühl, N., Hirschl, S.: Machine Learning Operations (MLOps): Overview, Definition, and Architecture. Draft paper.
Lecture slides.

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 26

A	B	C	D	E	FX
46,15	11,54	23,08	11,54	7,69	0,0

Lecturers: RNDr. Ľubor Šešera, PhD.
Last change: 19.06.2024
Approved by: prof. RNDr. Roman Ďurikovič, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KDMFI/2-AIN-139/14	Compilers and interpreters

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Active work on practice lessons at which a student solve assigned tasks is required. At least 80% of completed practice lessons are need to be admitted to the final examination. During the final examination, the student solves a test and according to obtained score, he/she receives a grade: A (90%), B (80%), C (70%), D (60%), E (50%) or FX (less than 50%).
Scale of assessment (preliminary/final): 0/100

Learning outcomes:
After completing the course student is able to analyze, evaluate and programming language design and compiler or interpreter to create a simple programming language.

Class syllabus:
Introduction to programming languages, compilers and interpreters
Virtual machine, code, memory management
Abstract syntax trees and other representations
Lexical analysis
Parsing
Namespaces
Code Generation
Error Handling
Algorithms for compiling language constructs, data structures and expressions

Recommended literature:
[1] Aho, Alfred V. [et al.]: Compilers : Principles, techniques, & tools. Boston : Pearson/Addison-Wesley, 2007
[2] Scott, Michael L.: Programming language pragmatics. Amsterdam ; Boston : Elsevier/Morgan Kaufmann Pub., 2009

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution Total number of evaluated students: 206					
A	B	C	D	E	FX
35,92	14,56	19,42	9,22	13,59	7,28
Lecturers: doc. RNDr. Ľubomír Salanci, PhD.					
Last change: 01.10.2025					
Approved by: prof. RNDr. Roman Ďurikovič, PhD.					

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-113/22	Computational Fuzzy Logic, Modeling and Systems

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Examination: examination is in written and oral form, two programming tasks and one theoretical question
Continuous assessment:
Approximate evaluation scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 0/100

Learning outcomes:
Theoretical and practical foundations of computational fuzzy logic, modelling, and systems.

Class syllabus:
1) Rule-based systems, the DPLL-procedure, binary resolution, hyper-resolution.
2) Uncertainty and its formalisation, triangular (co-)norms, continuity.
3) Many-valued (fuzzy) logics and computational formalisms (Lukasiewicz, Goedel, Product ones).
4) Fuzzy sets.
5) Fuzzy numbers and arithmetic.
6) Modifiers of fuzzy sets (hedges).
7) Fuzzy approximation models, F-transform, fuzzy cluster analysis.
8) Fuzzy inference, the compositional rule of inference (CRI).
9) Fuzzy rules - a Mamdani’s type.
10) Fuzzy rules - a Sugeno-Takagi's type.
11) The linguistic variable, a Zadeh’s approach.
12) Fuzzification.
13) Defuzzification.
14) Fuzzy inference systems, fuzzy controllers.

Recommended literature:
[1] Hájek, P. (1998). Metamathematics of fuzzy logic. Trends in Logic, vol. 4, Kluwer Academic Publishers.
[2] Klement, E. P., Mesiar, R., (2005). Logical, Algebraic, Analytic and Probabilistic Aspects of Triangular Norms, Elsevier.

[3] U. Schoening, J. Toran (2013), The Satisfiability Problem: Algorithms and Analyses, ser. Mathematik fuer Anwendungen. Lehmanns Media.
[4] Jantzen J. (2013). Foundations of Fuzzy Control: A Practical Approach, 2nd Edition, Wiley. ISBN: 978-1-118-50622-6.
[5] Novák, V., Perfilieva, I., & Dvorak, A. (2016). Insight into fuzzy modeling. John Wiley & Sons.
[6] Guller D. (2019). Hyperresolution for Goedel Logic with Truth Constants. Fuzzy Sets and Systems. 363: 1-65.

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 94

A	B	C	D	E	FX
55,32	31,91	7,45	0,0	0,0	5,32

Lecturers: doc. RNDr. Dušan Guller, PhD.

Last change: 29.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-108/15	Computational Logic

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Scale: A 90%, B 80%, C 70%, D 60%, E 50%
Semester:
- labs activity 10p (min 5p)
- homework 10p (min 5p)
- midterm 10p
- project 30p (min 15p)

Exam:
- oral exam 40p (min 20p)

Scale of assessment (preliminary/final): 60/40

Learning outcomes:
The course is concerned with problem solving by methods of computational logic, relying on modelling and automated inference. Students become acquainted with problem modelling in classical logic (SAT), and in logic programming (Prolog, ASP). The course focusses on the representational power of different formalisms and on algorithmic aspects (reasoning algorithms, their soundness and completeness). Students will get an overview of different implementations of reasoning algorithms, and practical experience with their usage.

Class syllabus:
- Classical propositional logic (recap)
- Encoding problems into SAT, using SAT sovlers
- Logic programming (syntax, SLDNF resolution, stable models)
- Encoding problems into logic programs, using LP solvers (Prolog, ASP)

Recommended literature:
Biere, A., Heule, M. and van Maaren, H. eds., 2009. Handbook of satisfiability (Vol. 185). IOS press.
Björk, M., 2011. Successful SAT encoding techniques. Journal on Satisfiability, Boolean Modeling
and Computation, 7(4), pp.189-201.

Sterling, L. and Shapiro, E.Y., 1994. The art of Prolog: advanced programming techniques. MIT press.
Baral, C., 2003. Knowledge representation, reasoning and declarative problem solving. Cambridge
university press.

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 234

A	B	C	D	E	FX
17,09	17,09	25,64	17,52	7,26	15,38

Lecturers: doc. RNDr. Martin Homola, PhD., Mgr. Júlia Pukancová, PhD., Mgr. Janka Boborová

Last change: 23.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-222/00	Computer Graphics Aplications

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
presentations
A 92%, B 84%, C 76%, D 68%, E 60
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Students will have knowledge of successful design projects and new trends in the application of methods and means of computer graphics.

Class syllabus:
1. Project presentations according to the project report distributed to the students
2. Projects and results done at the department
3. New trends and applications of computer graphics techniques.

Recommended literature:
J. Žára, B. Beneš, P. Felkel, Moderní počítačová grafika, Computer Press, Praha 1998
Project report from journal IEEE Computer and Graphics Applications
http://www.computer.org/portal/web/computingnow/cga
Internet

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 197

A	B	C	D	E	FX
50,76	13,2	17,26	7,61	6,6	4,57

Lecturers: prof. RNDr. Roman Ďurikovič, PhD.

Last change: 18.11.2021

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-147/19	Computer Vision

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2.

Educational level: II.

Prerequisites:

Antirequisites: FMFI.KAI+KAG/2-MPG-125/15

Course requirements:
Assessment: evaluation Preliminary assessment: Continuous assessment projects Final assessment: assessment examination 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:
Image Features extraction (Low, Medium and High level features)
Feature categories and application(Shape, Color, Texture...)
Object detection (Template matching, histogram of oriented gradients, Face detection and classification)
Local features (detectors, descriptors, matching, Ransac, Bag of visual words)
Dynamic Range of images, Tone Mapping a Gamut mapping
Image Quality metrics (SSIM and modifications)
Eye tracking (methods and applications)
Machine Vision and industry applications of computer vision (Laser line triangulation sensors, multispectral imaging)
Object Tracking (Tracking by detection, Optical flow)

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: 45

A	B	C	D	E	FX
26,67	13,33	15,56	17,78	24,44	2,22

Lecturers: RNDr. Zuzana Berger Haladová, PhD.

Last change: 27.11.2021

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-233/00	Computer Vision Applications

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 26
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 and activity on lectures
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:
Computer Vision and Image Understanding, Elsevier Inc., http://www.sciencedirect.com/science/journal/10773142
International Journal of Computer Vision Springer http://www.springerlink.com/content/0920-5691
IET Computer Vision http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=4159597
CVPR - Computer Vision and Pattern Recognition Workshops http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber=5521877

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 348

A	B	C	D	E	FX
50,57	21,84	11,21	2,01	4,89	9,48

Lecturers: doc. RNDr. Zuzana Černeková, PhD.

Last change: 23.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KDMFI/2-AIN-136/15	Creation of Educational Software

Educational activities:
Type of activities: course
Number of hours:
per week: 4 **per level/semester:** 52
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
evaluation of stage: design, develepment and testing the educational software
oral exam
Scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Student, teacher according to the requirements of practice, designs and develops educational software. Its development work in a team with one or two colleagues. Program design and test control in four stages. The result of the last stage of the operational program. Software develops methods action research (Design-Based Research). Student wrote a user manual for teachers.

Class syllabus:
Cooperation between the teacher (client) and the programmer of educational software, UML as a tool for their communication.
Requirements for educational software for teaching a specific topic at primary, secondary or university - interactivity, multimedia, openness of the software (settings, tasks, pictures, editor for teachers, student registration, tables and diagrams of student evaluation ...).
Software development in four stages. Evaluation of software from the perspective of teachers and students - software development by action research methods.
Desktop programs vs. web applications vs. mobile applications in the development and use of educational software. Platform independence of educational software.

Recommended literature:
Premeny školy v digitálnom veku / Ivan Kalaš a kolektív. Bratislava : Slovenské pedagogické nakladateľstvo - Mladé letá, 2013
T. Plomp, N. Nieveen et al. Educational Design Research. Slo 2013
vlastné elektronické texty zverejňované na webovej stránke, resp. v prostredí Moodle

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 58

A	B	C	D	E	FX
48,28	10,34	20,69	10,34	5,17	5,17

Lecturers: doc. PaedDr. Monika Tomcsányiová, PhD., Mgr. Lucia Budinská, PhD., Mgr. Mária Čujdíková, PhD.

Last change: 16.11.2021

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KDMFI/2-AIN-225/15	Creation of Multimedia Applications and Computer Games

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
Active work on practice lessons at which a student solve assigned tasks is required. At least 80% of completed practice lessons are need to be admitted to the final examination. During the final examination, the student solves a test and according to obtained score, he/she receives a grade: A (90%), B (80%), C (70%), D (60%), E (50%) or FX (less than 50%).
Scale of assessment (preliminary/final): 0/100

Learning outcomes:
After completing the course student is able to analyze, evaluate, design and create a simple game engine and multimedia applications.

Class syllabus:
Creation of interactive multimedia applications and computer games.
Representation of game objects and worlds.
Real time algorithms for motion, interaction and rendering video games in real time.
Algorithms for intelligent behaviour and solving strategic problems in video games.
Literature.

Recommended literature:
[1] Gregory, Jason: Game Engine Architecture. A K Peters/CRC Press 2018. ISBN 9781138035454
[2] Schell, Jesse: The Art of Game Design. CRC Press, 2019. ISBN: 9781138632059

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 214

A	B	C	D	E	FX
28,97	14,49	15,89	19,63	13,08	7,94

Lecturers: doc. RNDr. Ľubomír Salanci, PhD.
Last change: 01.10.2025
Approved by: prof. RNDr. Roman Ďurikovič, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-INF-188/22	Current Approaches in Machine Learning

Educational activities:
Type of activities: course
Number of hours:
per week: 4 **per level/semester:** 52
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 4.

Educational level: II.

Prerequisites:

Course requirements:
ongoing evaluation: homework, project
estimated grading curve: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
After completion of the course, students will be able to train modern architectures of neural networks, and efficiently use the scientific literature from this field.

Class syllabus:
Problems in neural network training (vanishing gradient, ...) and their solutions (Xavier's initialization,...); New architectures of neural networks (LSTM, GRU, GAN, Relu activation,...); Reinforced learning in neural networks; Current practical applications from literature

Recommended literature:
Goodfellow, Ian, Yoshua Bengio, and Aaron Courville. Deep learning. MIT press, 2016.; Papers from conferences NIPS, ICLR, ICML.

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 63

A	B	C	D	E	FX
53,97	9,52	11,11	4,76	6,35	14,29

Lecturers: Mgr. Vladimír Boža, PhD.

Last change: 02.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-155/22	Databases (2)

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Ongoing evaluation: presenting the assignment milestones according to the agreed schedule
Exam: written exam
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%
Weight of the intermediate / final evaluation: 50/50
Scale of assessment (preliminary/final): 50/50

Learning outcomes:
Student understands principles of SQL query processing in a relational database, understands how the query planner turns SQL query into a query plan and understands individual query plan steps, their limitations and trade-offs. Student understands indexing, various index types, and can select appropriate index for a particular situation. Student can use advanced features of relational databases: geographical data processing, XML and JSON data types and can write a complex recursive SQL query. Student can implement effective full-text search in a relational database and in a specialized database (Elasticsearch). Student understands NoSQL database concepts, their advantages and limitations and can choose appropriate database for a particular use-case.

Class syllabus:
1. Cost-Based optimalization and indexing
2. Multi-column indices, joins, aggregations indexing
3. Working with geo data
4. Spatial indices
5. Advanced data structures
6. Recursion in SQL
7. ACID
8. Fulltext search in SQL
9. NoSQL, distributed databases, motivation and overview
10. Distributed computing (Hadoop), columnar databases
11. Document databases (Elasticsearch)
12. Key-Value databases (Redis)
13. Graph databases (Neo4j)

Recommended literature:

- Date, C: An Introduction to Database Systems, Pearson; 8th edition, 2004.
- Zaniolo, C. et al.: Advanced database systems. Morgan Kaufmann Publishers, 1997.
- Smith, G.: PostgreSQL 9.0 High Performance, Packt Publishing, 2010.
- Winand, M.: SQL Performance Explained, 2012.
- Sadalage, P. J., Fowler, M.: NoSQL Distilled, A Brief Guide to the Emerging World of Polyglot Persistence, Addison-Wesley, 2012.
- Gheorghe, R., Hinman, M.L, Russo, R.: Elasticsearch in Action, Manning Publications Co., 2015.

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 42

A	B	C	D	E	FX
71,43	21,43	7,14	0,0	0,0	0,0

Lecturers: Ing. Tomáš Kramár, PhD., Ing. Michal Barla, PhD.

Last change: 25.11.2021

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-266/22	Declarative Programming

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 5

Recommended semester: 4.

Educational level: II.

Prerequisites:

Antirequisites: FMFI.KAI/2-AIN-266/17

Course requirements:
Preliminary assessment: homeworks, tests.
Scale: A 90%, B 80%, C 70%, D 60%, E 50%.
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
To give mathematical foundations of declarative programming languages.

Class syllabus:
1. Primitive Recursive Functions. Basic functions and operations. Explicit definitions. Bounded minimalization. Pairing function and arithmetization. Recursion with substitution in parameters. Nested simple recursion. Recursion with measure. Regular recursive definitions.
2. General Recursive Functions. Beyond primitive recursion: Ackermann-Péter function, universal function for primitive recursive functions. Primitive recursive indices. Transfinite recursion. General recursive functions. Regular minimalization. μ-Recursive functions.
3. Partial Recursive Functions. First recursion theorem (fixed point theorem). Computation model. Equivalence of the operational and denotational semantics. Partial recursive functions. Unbounded minimalization. Arithmetization of computation. Kleene normal-form theorem. Universal function. Recursive indices. Enumeration theorem. Partial μ-recursive functions. Church thesis. Recursively decidable, semidecidable and undecidable problems.

Recommended literature:
[1] Recursive Functions / Ján Komara. Online.
[2] Úvod do teórie algoritmov / Ivan Korec. Bratislava : Univerzita Komenského, 1983.

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 0

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

Lecturers: Ing. Ján Komara, PhD.

Last change: 26.11.2021

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-226/22	Deep Learning for Computer Vision

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
Continuous assessment: homework, project
Examination: oral examination
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 60/40

Learning outcomes:
Upon completion the student will have a good understanding of the theoretical background of various types of neural networks used in computer vision for classification, localization and object detection tasks as well as generative models. The student will also be able to create, implement, train and evaluate such networks with the use of hardware on PCs or in the cloud.

Class syllabus:
Introduction - machine learning basics, classical approaches to feature extraction, data splits and model evaluation, image manipulation basics
Classification - k-nearest neighbors method, linear classifier, loss functions, gradient optimization, regularization
Fully-connected NNs - computational graphs, vectorized computation, backpropagation, loss functions, automatic differentiation software, augmentation, dropout, stochastic optimization
Convolutional NNs - convolution, pooling, vanishing gradients, batch normalization, weight initialization, transfer learning, architectures
Recurrent NNs - sequential data, hidden states, LSTM, GRU, training regimes
Transformers - self-attention, transformers in NLP tasks, combinations with CNNs, transformers in computer vision
Object detection and segmentation - one and two stage object detectors, expansion of object detectors to segmentation, segmentation architectures, data annotation
Generative models - GAN, VAE
CNN visualization and understanding - learned features, style transfer, deep dream, adversarial examples, activation maps

Scientific and ethical problems of computer vision - data collection, privacy issues, computational dominance, method interpretability, safety, undesirable social effects, model bias, illusion of algorithmic objectivity

Recommended literature:

Ian Goodfellow and Yoshua Bengio and Aaron Courville: Deep learning, MIT Press, Online for free, http://www.deeplearningbook.org/

Michael Nielsen: Neural networks and deep learning, Online for free, http://neuralnetworksanddeeplearning.com/

Adrian Rosebrock: Computer Vision and deep learning, Resource guide

Languages necessary to complete the course:

Slovak, English

Notes:

Past grade distribution

Total number of evaluated students: 41

A	B	C	D	E	FX
9,76	12,2	24,39	26,83	9,76	17,07

Lecturers: doc. RNDr. Zuzana Černeková, PhD., Ing. Viktor Kocur, PhD.

Last change: 18.11.2021

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-283/22	Development of Critical Applications

Educational activities:
Type of activities: course
Number of hours:
per week: 4 **per level/semester:** 52
Form of the course: on-site learning

Number of credits: 5

Recommended semester: 3.

Educational level: II.

Prerequisites:

Antirequisites: FMFI.KAI/2-AIN-283/00

Course requirements:
Continuous assessment: exercises
Exam: exam
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Graduates will have personal experience with the use of formal methods in the specification and verification of selected (critical) applications.

Class syllabus:
The course follows the course Formal methods of software development, in which students got acquainted with the basic models for formal specification of systems (Process algebras, Petri nets, Time automata), with various logical calculations (especially based on modal and temporal logic) that are used for formal specification of system properties and model checking issues. In a series of practical critical applications (with emphasis on various communication protocols), students will learn to use these techniques - to specify the application and its formal description and verify whether the application meets it. They will use available model-checking software tools in their teaching. Within this subject, they themselves, with the help of a teacher, choose a suitable "critical" application and subsequently a suitable formalism for its specification and verification. Over the course of several iterations, they will improve, supplement and expand their solutions so that in the end they have personal experience with the deployment of formal methods.

Recommended literature:
Milner, R.: Communication and concurrency. Prentice-Hall
International, New York, 1989.
Reisig, W.: A Primer in Petri Net Design. Springer-Verlag, 1992
Jan A. Bergstra, Alban Ponse, and Scott A. Smolka, Editors. Handbook of Process Algebra, Elsevier, 2001.

Stirling C.: Modal and Temporal Properties of Processes, Springer (Texts in Computer Science), 2001

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 16

A	B	C	D	E	FX
68,75	6,25	6,25	12,5	0,0	6,25

Lecturers: doc. RNDr. Damas Gruska, PhD.

Last change: 26.11.2021

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-275/24	Development of Large Software Applications

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 1., 3.

Educational level: II.

Prerequisites:

Course requirements:
Continuous assessment: examples from exercises
Examination: oral or written examination
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 40/60

Learning outcomes:
The aim of the course is that students:
1. Understand the multi-tier architectures of large software systems
2. They gained practical experience with modern implementation of individual layers of such a system.
3. Gained practical experience with Continuous integration and delivery
In the lectures, students will first become familiar with the multi-tier architecture of large Internet / Intranet systems. Subsequently, they will learn how to implement a presentation layer based on modern frameworks for creating SPA (single-page applications). They will also learn how a complex application layer is developed in JavaEE / JakartaEE and .NET environments. Subsequently, students will learn how continuous systems are developed and deployed using Continuous integration and delivery techniques as part of DevOps. In the next part, students will move beyond the level of one system and get acquainted with different systems integration architectures. They will learn in more detail about web-based integration: SOAP and REST. Finally, students will see in the form of an illustrative example what are the typical software systems in a Slovak bank and how they are integrated with each other.
In the exercises, students implement a simple example of a multi-tier system in Angular from Google for client-side front-end and Microsoft .NET platform for the application layer. At the same time, they "wrap" the created application into the DevOps environment, first in the .NET platform
and then deploy it to the MS Azure cloud.

Class syllabus:
Brief syllabus of lectures:
1. Software system architecture and architectural views.

2. Multilayer architecture of internet / intranet systems.
3. Presentation layer: server pages
Strana: 1
4. Presentation layer: client pages
5. Presentation layer in mobile devices.
6. Application layer in JakartaEE.
7. Application layer in .NET
8. The connection of the application layer to the data layer
9. DevOps
10. Integration architectures
11. Web services (WS) based on SOAP and WS based on REST. Principles of GraphQL
Brief syllabus of the exercise:
1. Modeling of architectural views according to the principles of Rozanský and Woods (3 exercises)
2. Implementation of the presentation layer in the Angular framework (4 exercises)
3. Implementation of the application layer in the .NET framework (2 exercises)
4. Implementation of DevOps in .NET, DevOps in MS Azure cloud (2 exercises)

Recommended literature:

Základná:
ŠEŠERA, Ľ. – GREC, P. – NÁVRAT, P. Architektúra softvérových systémov: Architektúra internetových systémov a architektúra orientovaná na služby. Bratislava: Nakladateľstvo STU, 2011. 385 s. ISBN 978-80-227-3546-9.
Slajdy z prednášok.
Odporúčaná:
Fowler, M. et al.: Patterns of Enterprise Application Architecture. Addison-Wesley 2003.
Rozanski, N., Woods, E.: Software Systems Architecture: Working with Stakeholders Using Viewpoints and Perspectives. 2nd Edition. Addison-Wesley, 2011.
Hohpe, G., Woolf,B: Enterprise Integration Patterns: Designing, Building and Deploying Messaging
Solutions. Addison-Wesley, 2004.
Lindley, C.: Front-end Developer Handbook 2019.
https://frontendmasters.com/books/front-end-handbook/2019/
Zimmermann, O.: Building Service-Oriented Architectures with Web Services. Tutorial. OOPSLA 2008.
Angular: https://angular.io/docs
React: https://reactjs.org/docs/getting-started.html
Jakarta EE Tutorial (oficiálna dokumentácia Jakarta EE projektu):
https://eclipse-ee4j.github.io/jakartaee-tutorial/
gRPC: https://docs.microsoft.com/en-us/aspnet/core/grpc/?view=aspnetcore-6.0
GraphQL: https://docs.microsoft.com/en-us/shows/graphql/
Davis, J., Daniels, R.: Effective DevOps. O'Reilly 2016.
Riedesel, J.: Software Telemetry: Reliable logging and monitoring. Manning Publications 2021.

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 137

A	B	C	D	E	FX
33,58	23,36	24,82	13,87	3,65	0,73

Lecturers: RNDr. Ľubor Šešera, PhD.

Last change: 19.06.2024

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-276/24	Digital Twin Development

Educational activities:
Type of activities: course
Number of hours:
per week: 4 **per level/semester:** 52
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 3.

Educational level: II.

Prerequisites:

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

Learning outcomes:
Upon completion, students will have mastered the theoretical foundations and practical skills for authoring (both individually and in teams) digital twins.

Class syllabus:
Digital Twins: Definitions and Basic Concepts, Applications in Industry, Manufacturing, and Research (Digital
Model, Digital Shadow, Digital Thread, Digital Twin)
Definition of Basic Terms and Principles of Computer Graphics and Vision
3D Reconstruction of Static Objects for Digital Twins
3D Reconstruction of Dynamic Objects and Motion Capture of Objects and People
Data Capture (IoT, RTLS), Tracking, Streaming, and Fusion
Modeling and Simulation Techniques – Agents, Dynamic and Discrete Simulations
Case Study of Digital Twins (3D Reconstruction of an Office, Process Simulation in a Factory, Optimization of
an Automated Warehouse, etc.)
API and Commercial Software (UE, Omniverse, OpenUSD, Reality Capture, etc.)
Modeling, Simulation, and Visualization of a Project for a Digital Twin

Recommended literature:
Digital Twins in Industry / A.Y.C. Nee and S.K. Ong: MDPI, 2021, ISBN 978-3-0365-1799-5
Digital Twins: Basics and Applications / Zhihan Lv, Elena Fersman, Springer 2022, ISBN 978-3-031-11400-7
Digital Twin in manufacturing: A categorical literature review and classification / Werner Kritzinger et al. 2018, IFAC PapersOnLine 51-11 (2018) 1016–1022

Digital Twin: Origin to Future / Singh, M.; Fuenmayor, E.; Hinchy, E.P.; Qiao, Y.; Murray, N.; Devine, Appl. Syst. Innov. 2021, 4, 36.
Digital twin modeling method based on IFC standards for building construction processes / Dai C, Cheng K, Liang B, Zhang X, Liu Q and Kuang Z, 2024, Front. Energy Res.

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 10

A	B	C	D	E	FX
20,0	30,0	30,0	10,0	10,0	0,0

Lecturers: doc. RNDr. Martin Madaras, PhD.

Last change: 18.06.2024

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

STATE EXAM DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-991/22	Diploma Thesis

Number of credits: 15

Educational level: II.

Prerequisites: (FMFI.KAI/2-AIN-923/22 - Project Seminar (1) or FMFI.KAI/2-AIN-923/15 - Project Seminar (1)) and (FMFI.KAI/2-AIN-924/22 - Project Seminar (2) or FMFI.KAI/2-AIN-924/15 - Project Seminar (2))

Course requirements:

Interim evaluation: Written report - diploma thesis, which is assessed by the project leader and one opponent, its defense is a state exam. By enrolling in the subject of Diploma Thesis Defense, the student also registers for the state exam in the given academic year. If the student has not submitted the diploma thesis by the given deadline, the state examination is classified with the classification grade "FX".
Exam: State exam defense of diploma thesis
Scale of assessment (preliminary/final): 0/100

Learning outcomes:

The result is a written diploma thesis defended before the state commission.
1. Problem specification and its analysis.
2. Overview of the issue.
3. Methodology of problem solving.
4. Project decisions.
5. Work plan and its control.
6. Specification of software work.
7. Computational experiments and their evaluation.
8. Defense of the diploma thesis text.

Class syllabus:

Writing, preparing a presentation and defending a thesis.
The diploma thesis is taken into account when evaluating the subject of the state examination
- submitted diploma thesis and the level of achieved results with emphasis on creativity and implementation results (based on the opinions of the project leader and the opponent),
- work on the project during its solution (based on the opinion of the project leader),
- presentation and defense of the diploma thesis,
- statements and opinions in a wider professional debate.

State exam syllabus:

The result is a written diploma thesis defended before the state commission with the following structure
1. Problem specification and its analysis.
2. Overview of the issue.
3. Methodology of problem solving.
4. Project decisions.

5. Work plan and its control.
6. Specification of software work.
7. Computational experiments and their evaluation.
8. Defense of the diploma thesis text.
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Writing, preparing a presentation and defending a thesis.
The diploma thesis is taken into account when evaluating the subject of the state examination
- submitted diploma thesis and the level of achieved results with emphasis on creativity and implementation results (based on the opinions of the project leader and the opponent),
- work on the project during its solution (based on the opinion of the project leader),
- presentation and defense of the diploma thesis,
- statements and opinions in a wider professional debate.

Recommended literature:

Ako písať vysokoškolské a kvalifikačné práce : Ako písať seminárne práce, ročníkové práce, práce študentskej vedeckej a odbornej činnosti, diplomové práce, záverečné a atestačné práce, dizertácie / Dušan Katuščák. Bratislava : Stimul, 1998

http://dl.acm.org/dl.cfm?CFID=412417535&CFTOKEN=50913605

Languages necessary to complete the course:

Slovak, English

Last change: 18.11.2021

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/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:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Examination: an examination consisting of a written and an oral part
Continuous assessment: project, test The student must obtain at least 55% of points from the semester in order to take the final exam.
Indicative rating scale: A 90%, B 80%, C 70%, D 60%, E 50%
Weight of the mid-term / final evaluation: 50/50
Scale of assessment (preliminary/final): 50/50

Learning outcomes:
Theoretical foundations, methods and tools from Algebra and Discrete structures used in Informatics and Computer Graphics with examples and practical applications.

Class syllabus:
1) Selected chapters from elementary number theory, primality tests.
2) Modular arithmetic, congruences, Fermat's Little Theorem, Euler's Theorem
3) Algebraic structures: groups, rings, finite fields - practical examples
4) Orders of an element and of a group, primitive roots
6) Number systems: congruences, fast modular exponentiation,
7) Chinese Remainder Theorem, solving systems of linear congruences, application: error detecting and error-correcting codes
8) Pseudo-random numbers: the linear congruential generator
9) Matrix algebra, linear transformations
5) Quaternions
10) Modular matrices, application: Hill's cryptosystem
11) Determinants, application: Vandermond's determinant – secret sharing
12) One-way functions, discrete logarithm, one-way functions in algebraic structures
13) Applications of groups, finite fields, congruences: RSA cryptosystem, Knapsack cryptosystem,
14) Mathematical concept of symmetry: groups of automorphisms, isomorphisms, permutations

Recommended literature:
[1] Stanoyevitch, A. (2011) Discrete Structures with Contemporary Applications, CRC Press.

[2] Gersting, J.L. (2007) Mathematical Structures for Computer Science, 6th edition, W.H.Freeman and Company, NY.
[3] Gallian, J.A. (2012) Contemporary Abstract Algebra, 8th edition, Brooks/Cole, Boston
[4] Cormen, T.H. - Leiserson, C.E. - Rivest, R.L.- Stein,C. (2009) Introduction to Algorithms, 3nd edition, The MIT Press.
[5] Yamamura, A. - Jajcayová, T. - Kurokawa, T. (2005) Oblivious transfer and private information retrieval using homomorphic encryption functions, In: Proceedings of the 2005 Symposium on Cryptography and Information Security, Vol. 1. - Tokyo
[6] Jajcayová, T. (2019): Representations of permutation groups and semigroups on combinatiorial structures
In: Fifth Russian Finnish Symposium on Discrete Mathematics. S. 137-145. - ISBN 978-5-89896-704-8

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 67

A	B	C	D	E	FX
32,84	28,36	16,42	5,97	8,96	7,46

Lecturers: doc. RNDr. Tatiana Jajcayová, PhD.

Last change: 26.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KDMFI/2-AIN-234/24	E-learning Environments in Education

Educational activities:
Type of activities: course
Number of hours:
per week: 4 **per level/semester:** 52
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 4.

Educational level: II.

Prerequisites:

Recommended prerequisites:
2-AIN-224 Webové programovanie

Course requirements:
Intermediate assessment: practical assignments (25%), reviews (33%), project
Exam: practical
Indicative evaluation scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 60 / 40

Learning outcomes:
The student is able with respect to the specified educational requirements a) assess the various e-learning environments, b) specifies the requirements for e-learning environment, c) select the appropriate e-learning environment, respectively. suggest and implement new environment or a new module into the existing environment.

Class syllabus:
Overview, comparison, assessment and analysis of various e-learning environments, environments and systems for learning objects, school information systems.
Creating a specification of requirements for the educational environment.
Design and / or implementation of a module into an existing e-learning environment.
Current trends in e-learning.

Recommended literature:
Web- based training : Creating e-Learning experiences / Margaret Driscoll. San Francisco : Jossey-Bass , 2002
Own electronic texts published on the website, resp. in the Moodle environment.

Languages necessary to complete the course:
Slovak, English

Notes:
The course will start with a minimum number of students 4.

Past grade distribution
Total number of evaluated students: 0

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

Lecturers: PaedDr. Roman Hrušecký, PhD., prof. RNDr. Zuzana Kubincová, PhD., doc. RNDr. Ľudmila Jašková, PhD.

Last change: 01.10.2025

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-MXX-130/21	Elements of AI

Educational activities:
Type of activities: independent work
Number of hours:
per week: 25 **per level/semester:** 325
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 2., 8.

Educational level: I.II., II.

Prerequisites:

Course requirements:
Passing the online course https://course.elementsofai.com/ (in Enlish or Slovak version).

Learning outcomes:
The student will get acquainted with selected basic concepts of artificial intelligence and their use in solving various practical tasks.

Class syllabus:
1. What is artificial intelligence: related areas, AI philosophy.
2. Troubleshooting and UI: Browsing and troubleshooting, browsing and games
3. Probability and chance, Bayes' theorem, naive Bayesian classification.
4. Machine learning: nearest neighbor classifier, regression.
5. Neural networks: basics, creation, modern techniques.
6. Consequences: on predicting the future, the effects of AI on society, summary.

Recommended literature:
Russell S., Norwig P. (2010). Artificial Intelligence: A Modern Approach, (3rd ed.), Prentice Hall. Available in faculty library.
Marsland S. (2015). Machine Learning: An Algorithmic Perspective, (2nd ed.), CRC Press.

Languages necessary to complete the course:
Slovak or English

Notes:
The course consists of 20 numerical and 5 text-based tasks. Numerical tasks are checked automatically, text-based tasks are evaluated anonymously by students.

Past grade distribution
Total number of evaluated students: 95

A	B	C	D	E	FX
100,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Mária Markošová, PhD., prof. Ing. Igor Farkaš, Dr., doc. RNDr. Martin Takáč, PhD.
Last change: 22.08.2021
Approved by: prof. RNDr. Roman Ďurikovič, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-MXX-130/21	Elements of AI

Educational activities:
Type of activities: independent work
Number of hours:
per week: 25 **per level/semester:** 325
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1., 7.

Educational level: I.II., II.

Prerequisites:

Course requirements:
Passing the online course https://course.elementsofai.com/ (in Enlish or Slovak version).

Learning outcomes:
The student will get acquainted with selected basic concepts of artificial intelligence and their use in solving various practical tasks.

Class syllabus:
1. What is artificial intelligence: related areas, AI philosophy.
2. Troubleshooting and UI: Browsing and troubleshooting, browsing and games
3. Probability and chance, Bayes' theorem, naive Bayesian classification.
4. Machine learning: nearest neighbor classifier, regression.
5. Neural networks: basics, creation, modern techniques.
6. Consequences: on predicting the future, the effects of AI on society, summary.

Recommended literature:
Russell S., Norwig P. (2010). Artificial Intelligence: A Modern Approach, (3rd ed.), Prentice Hall. Available in faculty library.
Marsland S. (2015). Machine Learning: An Algorithmic Perspective, (2nd ed.), CRC Press.

Languages necessary to complete the course:
Slovak or English

Notes:
The course consists of 20 numerical and 5 text-based tasks. Numerical tasks are checked automatically, text-based tasks are evaluated anonymously by students.

Past grade distribution
Total number of evaluated students: 95

A	B	C	D	E	FX
100,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Mária Markošová, PhD.

Last change: 22.08.2021
Approved by: prof. RNDr. Roman Ďurikovič, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-233/13	English Conversation Course (1)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1., 3., 7., 9.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
tests, presentations, essays
Course prerequisites:
https://fmph.uniba.sk/microsites/kjp/katedra-jazykovej-pripravy/poziadavky-na-udelenie-priebezneho-hodnotenia-aj1aj2aj3-ostatne-kurzy/
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Continual improvement of all language skills focused on communication/speaking, listening comprehension and writing. The emphasis is on discourse, lexicology and morphology, word-bank broadening of communicational English as well as English for specific purposes appropriate for university students. This course is a follow up of the previously taught ESP course.

Class syllabus:
This course's focus is to broaden spoken/communicational English for students with B2/C1 level of English knowledge.

Recommended literature:
Appropriate study material is supplied based on the participants'level of English by the lecturer. (Sources- The Guardian, The Herald Morning Sun. The Nine News, The West Australian, BBC News and podcasts, CNN podcasts).

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 318

A	B	C	D	E	FX
77,36	8,81	4,4	1,26	0,94	7,23

Lecturers: Mgr. Aneta Barnes

Last change: 11.04.2024
Approved by: prof. RNDr. Roman Ďurikovič, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-234/13	English Conversation Course (2)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 2., 4., 8., 10.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
tests, oral presentations, essays
Course prerequisites:
https://fmph.uniba.sk/microsites/kjp/katedra-jazykovej-pripravy/poziadavky-na-udelenie-priebezneho-hodnotenia-aj1aj2aj3-ostatne-kurzy/
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Continual improvement of all language skills focused on communication/speaking, listening comprehension and writing. The emphasis is on discourse, lexicology and morphology, word-bank broadening of communicational/spoken English as well as English for specific purpose appropriate for university students. This course is a follow up of the Conversational English course 1.

Class syllabus:
This course's focus is to broaden spoken/communicational English for students with B2/C1 level of English knowledge(Upper-Intermediate/Lower Advanced).

Recommended literature:
Appropriate study material is supplied based on the participants'level of English by the lecturer. (Sources- The Guardian, The Herald Morning Sun. The Nine News, The West Australian, BBC News and podcasts, CNN podcasts).

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 201

A	B	C	D	E	FX
82,09	8,96	2,49	1,0	0,0	5,47

Lecturers: Mgr. Aneta Barnes

Last change: 11.04.2024
Approved by: prof. RNDr. Roman Ďurikovič, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-181/24	Evolutionary Algorithms

Educational activities:
Type of activities: course
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 4.

Educational level: II.

Prerequisites:

Course requirements:
Continuous assessment: elaboration of projects for exercises
Exam: exam
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
To acquaint students with basic methods of evolutionary algorithms. To show the problems that can be solved with them, to point out the advantages and disadvantages of individual types of evolutionary algorithms and their suitability for solving those optimization problems. To teach students to practically solve such problems on the basis of developed projects.

Class syllabus:
(1) Optimization problems and their solutions. Biological inspiration for evolutionary algorithms.
(2) Darwin's evolution as an algorithm, coding, local search.
(3) Genetic algorithm, genetic programming, theoretical foundations, use to solve combinatorial problems.
(4) Evolutionary strategy method, simulated annealing method.
(5) More complex evolutionary algorithms.
(6) Artificial life.

Recommended literature:
Introduction to evolutionary computing / A. E. Eiben, J. E. Smith. Berlin : Springer, 2003
Evolučné algoritmy / Vladimír Kvasnička, Jiří Pospíchal, Peter Tiňo. Bratislava : Slovenská technická univerzita, 2000

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 4

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

Lecturers: doc. RNDr. Mária Markošová, PhD.

Last change: 28.05.2024

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-133/15	Extreme Programming

Educational activities:
Type of activities: course
Number of hours:
per week: 4 **per level/semester:** 52
Form of the course: on-site learning

Type, volume, methods and workload of the student - additional information
EN
After completing the course, students will be able to use the methods and techniques Extreme Programming methodology: pair programming, writing and using unit tests, test driven programming, clean code, refactoring, code review, working with legacy code. Agile using of ChatGPT – advantages and drawbacks. Principles of agile project management methodology in the form of extreme programming.

Number of credits: 6

Recommended semester: 2.

Educational level: I., II.

Prerequisites:

Recommended prerequisites:
No

Antirequisites: FMFI.KAI/1-AIN-680/00

Course requirements:
Continuous evaluation: exercises, presentations, homework assignments (50%), final exam (30%), final essay: (20%). Final grade: 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 use the methods and techniques of extreme programming methodology: pair programming, defining and use of unit tests, test driven programming, clean code, refactoring, code review, working with legacy code. Using Chat GPT in programming: advantages and drawbacks. They will be able to organize work according methodology of extreme programming.

Class syllabus:
History of software engineering, life cycle of software systems, traditional and agile methodologies, pillars of extreme programming (XP): pairwise programming, test driven programming, typology of tests and their use, refactoring and its techniques, principles of writing clean code, code review, legacy code, principles of project management in XP. ChatGPT in programming: advantages and drawbacks.

Recommended literature:

Beck, Kent, 1999: Extreme Programming Explained, Addison-Wesley Professional, Martin, Robert C. 2008: Clean Code: A Handbook of Agile Software Craftsmanship, Pearson; 1st edition, Fowler, Martin, 2018: Refactoring: Improving the Design of Existing Code, Addison-Wesley Langr, Jeff, 2013: Modern C++ Programming with Test-Driven Development, The Pragmatic programmers, LLC Amr Noaman, 2018: Refactoring to Clean Code. Concepts and Techniques for Taming Wild Code, The Pragmatic Bookshelf, Dallas, http://leanpub.com/RefactoringToCleanCode Feathers, Michael C, 2005: Working Effectively with Legacy Code, Prentice Hall Bernstein, David Scott, 2015: Beyond Legacy Code, Nine Practices to Extend the Life (and Value) of Your Software, The Pragmatic Bookshelf, Dallas, Texas – Raleigh, North Carolina Whittaker, James A., 2011, Exploratory Software Testing, Addison-Wesley, Callaghan, Michael D., 2023, Pair Programming with ChatGPT, Independently published

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 355

A	B	C	D	E	FX
65,07	9,01	9,86	5,63	6,48	3,94

Lecturers: Ing. František Gyarfaš, CSc., Mgr. Ivor Uhliarik, PhD.

Last change: 23.08.2023

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

COURSE DESCRIPTION

Academic year: 2026/2027	
University: Comenius University Bratislava	
Faculty: Faculty of Mathematics, Physics and Informatics	
Course ID: FMFI.KAI/2-AIN-185/22	**Course title:** Formal Methods of Software Development
Educational activities: **Type of activities:** lecture / practicals **Number of hours:** **per week:** 3 / 1 **per level/semester:** 39 / 13 **Form of the course:** on-site learning	
Number of credits: 5	
Recommended semester: 4.	
Educational level: II.	
Prerequisites:	
Course requirements: exercises, exams A 90%, B 80%, C 70%, D 60%, E 50% Scale of assessment (preliminary/final): 40/60	
Learning outcomes: Graduates of this subject will know the basic models, the formalisms and techniques used in formal specification and verification of methods.	
Class syllabus: Students will learn some basic models exploited in formal specifications of systems (Process Algebras, Petri nets, Timed Automata ..), their syntax and semantics which are suitable for different applications in formal specifications. Also some modal and temporal logics which are exploited in systems specifications will be tought together with some basics on model checking.	
Recommended literature: Milner, R.: Communication and concurrency. Prentice-Hall International, New York, 1989. Reisig, W.: A Primer in Petri Net Design. Springer-Verlag, 1992 Jan A. Bergstra, Alban Ponse, and Scott A. Smolka, Editors. Handbook of Process Algebra, Elsevier, 2001. Stirling C.: Modal and Temporal Properties of Processes, Springer (Texts in Computer Science), 2001	
Languages necessary to complete the course: Slovak, English	
Notes:	

Past grade distribution
Total number of evaluated students: 558

A	B	C	D	E	FX
22,04	13,8	19,35	24,19	18,82	1,79

Lecturers: doc. RNDr. Damas Gruska, PhD.

Last change: 23.11.2021

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-141/00	French Language (1)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1., 7.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:

Class syllabus:
French language is taught at two levels: beginner and intermediate. Students opt for one of them depending on whether they wish to obtain the fundamentals of the language or wish to maintain and/or improve previous knowledge of French.

Recommended literature:
Capelle Guy, Menand Robert: Le Nouveau taxi 1, Hachette FLE Paris, France 2009, ISBN 978-2-01-155548 - 9

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 499

A	B	C	D	E	FX
48,5	19,44	16,63	7,82	2,0	5,61

Lecturers: Mgr. Ľubomíra Kožehubová

Last change: 20.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-142/00	French Language (2)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 2., 8.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:

Class syllabus:
The subject continues the program of French language (1) and provides courses of essential and intermediate French language.

Recommended literature:
Capelle Guy, Menand Robert: Le Nouveau taxi 1, Hachette FLE Paris, France 2009, ISBN 978-2-01-155548 - 9

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 307

A	B	C	D	E	FX
45,6	22,48	16,94	8,79	2,28	3,91

Lecturers: Mgr. Ľubomíra Kožehubová

Last change: 20.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-241/00	French Language (3)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 3., 9.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:

Class syllabus:
The subject provides a course of intermediate French language, covering not only general, but also technical language.

Recommended literature:
Capelle Guy, Menand Robert: Le Nouveau taxi 1, Hachette FLE Paris, France 2009, ISBN 978-2-01-155548 - 9

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 128

A	B	C	D	E	FX
48,44	24,22	17,19	5,47	0,78	3,91

Lecturers: Mgr. Ľubomíra Kožehubová

Last change: 20.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-242/00	French Language (4)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 4., 10.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:

Class syllabus:
The subject provides a course of intermediate French covering not only general, but also technical French language.

Recommended literature:
Menand Robert: Le Nouveau taxi 2, Hachette FLE, Paris, France 2009, ISBN 978-2-01-155551 - 9

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 79

A	B	C	D	E	FX
43,04	32,91	16,46	2,53	1,27	3,8

Lecturers: Mgr. Ľubomíra Kožehubová

Last change: 20.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-116/14	Functional Programming

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2.

Educational level: II.

Prerequisites:

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

Learning outcomes:
students will know what is functional programming, basics of lambda calculus and advanced technology functional programming

Class syllabus:
Functional pearls, R.Bird
The transformation of functional programs
Functional morphisms a scheme recursion
Introduction to the lambda calculus
Properties lambda theory
Interpreter lambda calculus
Type systems
Logic combinators
Monadic parsing and parsers
Monads

Recommended literature:
Functional programming : practice and theory / Bruce J. MacLennan. Reading : Addison-Wesley, 1989
Haskell the craft of functional programming / Simon Thompson. Harlow : Pearson, 1999
Abstract computing machines : A lambda calculus perspective / W. Kluge. Berlin : Springer, 2005

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution Total number of evaluated students: 119					
A	B	C	D	E	FX
49,58	2,52	15,97	10,08	21,01	0,84
Lecturers: RNDr. Peter Borovanský, PhD., doc. RNDr. Dušan Guller, PhD.					
Last change: 14.03.2022					
Approved by: prof. RNDr. Roman Ďurikovič, PhD.					

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-134/14	Geometric modelling in graphics

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Projects, oral exam
For the semester, the student can get 50% for exercises, the final exam in the form of a presentation of a chapter from the book has a weight of 50%. The student must solve each task in the exercises at least 30% in order to pass the final exam. Grading: 92-100 A, 84-91 B, 76-83 C, 68-75 D, 60-67 E. Details on the subject page.
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:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 25

A	B	C	D	E	FX
40,0	16,0	20,0	8,0	12,0	4,0

Lecturers: prof. RNDr. Roman Ďurikovič, PhD.

Last change: 20.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-151/00	German Language (1)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1., 7.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
To master the fundamentals of the common language and basic technical terms of particular fields of study (depending on the student's level of German proficiency)

Class syllabus:
German language is taught at three levels: beginner, intermediate and advanced. Students opt for one of them depending on whether they need to learn the fundamentals or maintain and/or improve their previous knowledge.
This course's focus is to master the fundamentals of the common language and basic technical terms of particular fields of study (depending on the student's level of German proficiency)

Recommended literature:
Appropriate study material is supplied by teacher based on the participants'level of German proficiency.

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 874

A	B	C	D	E	FX
38,33	24,71	18,42	8,81	2,86	6,86

Lecturers: Mgr. Alexandra Maďarová, Mgr. Simona Dobiašová, PhD.

Last change: 05.09.2025

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-152/00	German Language (2)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 2., 8.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
To master the fundamentals of the common language and basic technical terms of particular fields of study (depending on the student's level of German proficiency)

Class syllabus:
German language is taught at two levels: beginner and intermediate. Students opt for one of them depending on whether they wish to obtain the fundamentals of the language or wish to maintain and/or improve previous knowledge of German.
This course’s focus is to to master the fundamentals of the common language and basic technical terms of particular fields of study (depending on the student's level of German proficiency)

Recommended literature:
Appropriate study material is supplied by teacher based on the participants’level of German proficiency

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 542

A	B	C	D	E	FX
38,01	19,56	19,56	12,36	3,51	7,01

Lecturers: Mgr. Alexandra Maďarová, Mgr. Simona Dobiašová, PhD.

Last change: 05.09.2025

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-251/00	German Language (3)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 3., 9.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Master the basics of general language and basic professional terminology of individual fields of study (depending on the advanced level of students)

Class syllabus:
The course is a follow-up to the German language (1,2). The subject provides a course of intermediate or advanced German language.
This course's focus is to deepen the knowledge of the common language and basic technical terms of particular fields of study (depending on the student's level of German proficiency).

Recommended literature:
Appropriate study material is supplied by teacher based on the participants'level of German proficiency.

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 191

A	B	C	D	E	FX
45,03	23,04	19,37	6,81	2,09	3,66

Lecturers: Mgr. Alexandra Maďarová, Mgr. Simona Dobiašová, PhD.

Last change: 05.09.2025

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-252/00	German Language (4)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 4., 10.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Master the basics of general language and basic professional terminology of individual fields of study (depending on the advanced level of students)

Class syllabus:
The course is a follow-up to the German language (1-3). It provides a course of intermediate and advanced German language.
This course's focus is to deepen the knowledge of the common language and basic technical terms of particular fields of study (depending on the student's level of German proficiency).

Recommended literature:
Appropriate study material is supplied by teacher based on the participants'level of German proficiency.

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 104

A	B	C	D	E	FX
44,23	22,12	14,42	10,58	3,85	4,81

Lecturers: Mgr. Alexandra Maďarová, Mgr. Simona Dobiašová, PhD.

Last change: 05.09.2025

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-129/15	Informatics - Generic Subject

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

Number of credits: 6

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Continuous assessment: The number of credits and the conditions of fulfillment are given by the rules of the foreign university.
Examination: written, oral
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Ability to keep in touch with the latest developments in their discipline within the subjects. After completing the course, students will learn how to study abroad, make new contacts in their field, on which they can build their professional growth, learn about a new cultural environment, learn how to adapt to a foreign team, improve communication skills.

Class syllabus:
Subject in the field of artificial intelligence and informatics. The course is intended only for students who complete part of their studies at foreign universities as part of study stays on the basis of an agreement. The choice of the subject is subject to the consent of the guarantor of the study program. The number of credits and the conditions of fulfillment are determined by the rules of the foreign university.

Recommended literature:

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 8

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

Lecturers: prof. RNDr. Roman Ďurikovič, PhD.

Last change: 18.11.2021
Approved by: prof. RNDr. Roman Ďurikovič, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-101/15	Information Systems - Generic Subject

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

Number of credits: 6

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Continuous assessment: The number of credits and the conditions of fulfillment are given by the rules of the foreign university.
Examination: written, oral
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Ability to keep in touch with the latest developments in their discipline within the subjects. After completing the course, students will learn how to study abroad, make new contacts in their field, on which they can build their professional growth, learn about a new cultural environment, learn how to adapt to a foreign team, improve communication skills.

Class syllabus:
Subject in the field of information systems. The course is intended only for students who complete part of their studies at foreign universities as part of study stays on the basis of an agreement. The choice of the subject is subject to the consent of the guarantor of the study program. The number of credits and the conditions of fulfillment are determined by the rules of the foreign university.

Recommended literature:

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 8

A	B	C	D	E	FX
25,0	37,5	12,5	25,0	0,0	0,0

Lecturers: prof. RNDr. Roman Ďurikovič, PhD.

Last change: 18.11.2021

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.CENAM/2-MXX-134/26	Innovation and Entrepreneurship in Natural and Technical Sciences

Educational activities:
Type of activities: lecture / independent work
Number of hours:
per week: 2 / 1 **per level/semester:** 26 / 13
Form of the course: on-site learning

Type, volume, methods and workload of the student - additional information
2/1 (lecture / individual work)

Number of credits: 3

Recommended semester: 1., 7.

Educational level: I.II., II.

Prerequisites:

Course requirements:
The condition for admission to the exam is active participation in at least 80% of the lessons.
The final assessment consists of a presentation of the semester project. To successfully complete the course, it is necessary to achieve at least 50% of the overall score.
Scale of assessment (preliminary/final): 0/100

Learning outcomes:
After completing the course, students can describe the possibilities for commercialization of scientific and technological research. They can identify market needs, assess the market potential of a technological solution, and are familiar with the terminology of entrepreneurship, technology transfer, and intellectual property protection. They understand the overall structure of a business plan and the main forms of financing for technological projects. They are familiar with the principles of communication, teamwork, and team leadership and can apply them appropriately in project work and its presentation.

Class syllabus:
1. Commercialization of scientific research.
2. Fundamentals of entrepreneurship and startup terminology.
3. Identification of problems and customer needs analysis (design thinking).
4. Technology transfer. Technology Readiness Levels (TRL).
5. Intellectual property and its protection.
6. Market, customer, and market potential of a technological solution.
7. Business Model Canvas. Revenue models.
8. Sources of financing for technological projects.
9. Pitching and communication of the solution.
10. Fundamentals of management and leadership.
11. Innovation support and incubation structures at national and international levels.

Recommended literature:
Clark, Timothy R., et al. Business Model Generation. Wiley, 2010

Languages necessary to complete the course:
Slovak

Notes:

Past grade distribution
Total number of evaluated students: 0

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

Lecturers: doc. RNDr. Tomáš Plecenik, PhD., Mgr. Veronika Hidaši Turiničová, PhD.

Last change: 13.03.2026

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KDMFI+KAI/2-MXX-131/21	International Team-based Research Project

Educational activities:
Type of activities: course / independent work
Number of hours:
per week: 3 **per level/semester:** 39 / 30s
Form of the course: on-site learning

Number of credits: 5

Recommended semester: 1., 7.

Educational level: I.II., II.

Prerequisites:

Course requirements:
Continuous assessment: active participation in research in an international student team (25%), presentation of work in a workshop (25%), scientific article (50%)
Indicative evaluation scale: A 90 %, B 80 %, C 70 %, D 60 %, E 50 %
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Students will learn in the team to agree on a common research topic, formulate research questions, determine research methods for the problem, collect and evaluate data, discuss their findings, present research results to the professional public, analyze and evaluate the scientific work of their colleagues, prepare a scientific article suitable for publication

Class syllabus:
- Research methodology
- Design and implementation of a research project in an international group (preferably interdisciplinary)
- Methods and tools for collaboration in virtual space, collaboration in science and practice
- Academic writing, presentation of research results through scientific articles; objectives, content and structure of scientific articles; forms of academic publication, publication forums and evaluation of their quality
- Quality assurance and feedback - peer review
- Communication of results through posters or conference presentations

Recommended literature:
- Teachers' own electronic study materials published on the course website or in the Moodle system
- Gavora, Peter a kol. 2010. Elektronická učebnica pedagogického výskumu. [online]. Bratislava : Univerzita Komenského, 2010. Dostupné na: http://www.e-metodologia.fedu.uniba.sk/ ISBN 978–80–223–2951–4.

- Tharenou, P., Donohue, R. and Cooper, B., 2007. Management research methods. Cambridge University Press.
- Topping, A., 2015: The Quantitative-Qualitative Continium. In: Gerrish, K. and Lathlean, J., The Research Process in Nursing, p. 159-172
- Williamson, K. and Johanson, G. eds., 2017. Research methods: Information, systems, and contexts. Chandos Publishing.

Languages necessary to complete the course:
English

Notes:

Past grade distribution
Total number of evaluated students: 10

A	B	C	D	E	FX
70,0	0,0	0,0	0,0	30,0	0,0

Lecturers: prof. RNDr. Zuzana Kubincová, PhD., doc. RNDr. Martin Homola, PhD.

Last change: 22.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-144/15	Knowledge Representation and Reasoning

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
Scale: A 90%, B 80%, C 70%, D 60%, E 50%
Semester:
- labs activity 10p (min 5p)
- homework 10p (min 5p)
- midterm 10p
- project 30p (min 15p)

Exam:
- oral exam 40p (min 20p)

Scale of assessment (preliminary/final): 60/40

Learning outcomes:
The course is concerned with problem solving by methods of computational logic, relying on modelling and automated inference: ontologies and their role in knowledge representation, modelling of ontologies and knowledge bases, description logics, deduction, induction abduction, explanatory reasoning. Students gain insight into the various methods of inference in terms of semantics and algorithms.

Class syllabus:
- Knowledge representation and reasoning
- Ontologies and knowledge bases
- Description logics as a logical foundation for representation and reasoning with ontologies
- Inference algorithms for description logics (deduction)
- Ontology-based data access
- Induction and abduction
- Finding explanations
- Practical application of knowledge representation and reasoning

Recommended literature:
Van Harmelen, F., Lifschitz, V. and Porter, B. eds., 2008. Handbook of knowledge representation. Elsevier.

Baader, F., Horrocks, I., Lutz, C. and Sattler, U., 2017. Introduction to description logic. Cambridge University Press.
Baader, F., Calvanese, D., McGuinness, D., Patel-Schneider, P. and Nardi, D. eds., 2003. The description logic handbook: Theory, implementation and applications. Cambridge university press.
Staab, S. and Studer, R. eds., 2010. Handbook on ontologies. Springer Science & Business Media.
Research papers.

Languages necessary to complete the course:
English, Slovak

Notes:

Past grade distribution
Total number of evaluated students: 38

A	B	C	D	E	FX
44,74	23,68	18,42	5,26	5,26	2,63

Lecturers: doc. RNDr. Martin Homola, PhD., Mgr. Júlia Pukancová, PhD.

Last change: 23.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-188/15	Life Cycle of Infornation Systems

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 4.

Educational level: II.

Prerequisites:

Course requirements:
During semester: submitting of partial work
Final grade depends on the project
Evaluation based on scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Students will understand later phases of information systems life cycle - service and support, working with legacy code.

Class syllabus:
1. Software development life cycle.
2. Relation to information systems development models
3. Deployment
4. Versioning
5. Software maintenance - planning
6. Software maintenance - processes
7. Software maintenance - categorization
8. Customer support – tools and methods
9. Reverse engineering
10. Integration

Recommended literature:
Software engineering : The production of quality software / Shari Lawrence Pfleeger. New York : Macmillan, 1987

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 2

A	B	C	D	E	FX
100,0	0,0	0,0	0,0	0,0	0,0

Lecturers: Mgr. Pavel Petrovič, PhD.

Last change: 18.11.2021

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-INF-150/15	Machine Learning

Educational activities:
Type of activities: lecture
Number of hours:
per week: 4 **per level/semester:** 52
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 1.

Educational level: II.

Prerequisites:

Recommended prerequisites:
(1-INF-115 Algebra (1) OR 1-AIN-152 Linear Algebra) AND 2-INF-175 Probability and Statistics

Course requirements:
homework assignments (30%), project (30%), final exam (40%)
To pass the exam, a student has to get at least half of the points on the exam.
A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 60/40

Learning outcomes:
Students will be familiar with basic machine learning techniques, and they will be able to use these techniques in practical applications.

Class syllabus:
Supervised machine learning (linear and generalized linear regression, neural networks, classification with support vector machines, kernel methods, discrete classifiers). Machine learning theory (statistical model of machine learning, bias-variance trade-off, overfitting and underfitting, PAC learning, VC dimension estimates). Unsupervised machine learning (clustering, self-organizing maps, principal component analysis). Reinforcement learning. Ensemble learning (bagging, boosting).

Recommended literature:
The elements of statistical learning : Data mining, inference, and prediction / Trevor Hastie, Robert Tibshirani, Jerome Friedman. New York : Springer, 2009
Pattern recognition and machine learning / Christopher M. Bishop. New York : Springer, 2006
Machine learning / T. M. Mitchell. New York : McGraw Hill, 1997
Biological sequence analysis : Probabilistic models of proteins and nucleic acids / Richard Durbin ... [et al.]. Cambridge : Cambridge University Press, 1998

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 367

A	B	C	D	E	FX
47,41	14,44	11,17	7,63	7,63	11,72

Lecturers: Mgr. Vladimír Boža, PhD., Mgr. Marek Šuppa, doc. Mgr. Tomáš Vinař, PhD.

Last change: 24.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-119/15	Mathematics - Generic Subject

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

Number of credits: 6

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Continuous assessment: The number of credits and the conditions of fulfillment are given by the rules of the foreign university.
Examination: written, oral
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Course in the field of advanced mathematics, numerical and optimization methods. Ability to keep in touch with the latest developments in their discipline within the subjects. After completing the course, students will learn how to study abroad, make new contacts in their field, on which they can build their professional growth, learn about a new cultural environment, learn how to adapt to a foreign team, improve communication skills.

Class syllabus:
The course is intended only for students who complete part of their studies at foreign universities as part of study stays on the basis of an agreement. The choice of the subject is subject to the consent of the guarantor of the study program. The number of credits and the conditions of fulfillment are determined by the rules of the foreign university.

Recommended literature:

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 3

A	B	C	D	E	FX
0,0	0,0	100,0	0,0	0,0	0,0

Lecturers: prof. RNDr. Roman Ďurikovič, PhD.

Last change: 18.11.2021
Approved by: prof. RNDr. Roman Ďurikovič, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI+KI/1-BIN-301/15	Methods in Bioinformatics

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 1.

Educational level: I., II.

Prerequisites:

Course requirements:
Homework assignments (30%), group project (10%), weekly quizzes (10%), written exam (50%). Grades: A 90%, B 80%, C 70%, D 60%, E 50%. More information on the course website.
Scale of assessment (preliminary/final): 50/50

Learning outcomes:
Students will be familiar with basic problems and methods in bioinformatics; they will be able to choose an appropriate method for a given biological problem and to interpret its results.

Class syllabus:
Basic concepts from molecular biology, algorithms and machine learning. Sequencing and assembling genomes. Gene finding. Sequence alignment. Evolutionary models and phylogenetic trees. Comparative and population genomics. RNA structure. Motif finding and gene expression analysis. Protein structure and function. Selected current topics.
Students of computer science programs will focus on computer science methods and mathematical modeling of the covered problems.

Recommended literature:
Biological sequence analysis : Probabilistic models of proteins and nucleic acids / Richard Durbin ... [et al.]. Cambridge : Cambridge University Press, 1998
Understanding bioinformatics / Marketa Zvelebil, Jeremy O. Baum. New York : Garland Science, 2008

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 263

A	B	C	D	E	FX
28,14	16,73	21,29	18,25	7,22	8,37

Lecturers: doc. Mgr. Bronislava Brejová, PhD., doc. Mgr. Tomáš Vinař, PhD., Mgr. Askar Gafurov, PhD.
Last change: 14.01.2025
Approved by: prof. RNDr. Roman Ďurikovič, PhD.

STATE EXAM DESCRIPTION

Academic year: 2026/2027	
University: Comenius University Bratislava	
Faculty: Faculty of Mathematics, Physics and Informatics	
Course ID: FMFI.KAI/2-AIN-953/22	**Course title:** Methods of Applied Informatics
Number of credits: 6	
Educational level: II.	
Learning outcomes: The student consolidates the knowledge and skills acquired during the master's study and understands their interrelationships and the context in which they act.	
Class syllabus: The syllabi of the exam, which are published in advance, are based on the content of the profile subjects, but are not linked to them. List of recommended subjects: Mathematical modeling and computer animation of physical processes; Formal software development methods; Discrete structures in informatics; Computational fuzzy logic, modeling and systems; Machine learning.	
State exam syllabus: The syllabi of the exam, which are published in advance, are based on the content of the profile subjects, but are not linked to them. List of recommended subjects: Mathematical modeling and computer animation of physical processes; Formal software development methods; Discrete structures in informatics; Computational fuzzy logic, modeling and systems; Machine learning. 9.2.9 Syllabuses of state examinations of the master's study program Applied Informatics a Applied informatics (conversion program) State subject 2-AIN-991/15 Master's thesis defense State subject 2-AIN-953/15 Methods of Applied Informatics The student pulls one question at random. 2-AIN-185/00 Formal methods of software development - D. Gruska 1. Explain the principle of bisimulation and its use to verify the properties of programs. 2. Modal and temporal logics and their use for verification of program properties. 3. Process algebras, syntax, semantics, usage. 4. Time automata, principles, properties and uses. 5. Petri nets, types, properties and uses. 2-AIN-206/15 Mathematical Modeling and Computer Animation of Physical Processes - R. Ďurikovič 6. Animations of motion and orientation, nearest neighbor, linear interpolation, interpolation spline for motion animation, Cubic Bézier interpolation curve, C1 continuity of curve composition. 7. Quaternion and orientation, axis of rotation and angle, representation by quaternions, rotation in space by quaternions, inverse quaternion, composition of rotation of two quaternions, interpolation SLERP (Spherical Linear Interpolation), interpolation of two or more quaternions, Catmull-Rom interpolation.	

8. Collision detection, necessary and sufficient condition when there are no two bodies in collision, dividing plane, broad phase (hierachical grid), mid phase (envelope hierarchy, Voronoi areas in collision, explain on the example of collision ball x capsule, decomposition of a body on convex parts), narrow phase (Minkowski space and proximity of convex bodies).
9. Numerical solution of differential equations, ODE first order separable, Equations of motion first order velocity, acceleration, Euler's method, MidPoint method, Runge-Kuta method, stability condition for time step selection.
10. Dynamics of rigid bodies, problem definition, position, center of gravity and orientation of a body, equation of motion (4 ODE), velocity, acceleration, angular velocity and angular acceleration, momentum matrix (inertia matrix) momentum matrix for a sphere, fixed block, displaced block.
2-INF-150/15 Machine learning - V. Boža, M. Šuppa, T. Vinař
11. Regression. Linear regression, solution using normal equations and gradient method, generalized linear regression, regularization.
12. Neural networks. Differences between logistic regression and simple perceptron. Hidden layers in neural networks. Convolutional neural networks. Back promotion method.
13. Support vector machines. Basic formulation, dual formulation. Kernel method.
14. Voting schemes. Bagging and boosting. Application to decision trees. Random forests.
15. Theory of machine learning. Mathematical model of machine learning. Deviation and variance. Holdout testing. PAC (probably approximately correct) learning, VC (Vapnik-Cervonenkis) dimension.
2-AIN-113/22 Computational fuzzy logic, modeling and systems - D. Guller
16. Residual unions - basic properties, triangular (co-) norms, residuals, continuity, manyvalued (MV), Goedel (G), product (P) algebras / varieties.
17. Fuzzy logics and computational formalisms (Lukasiewicz, Goedel, product), Davis – Putnam – Logemann – Loveland (DPLL) procedure, binary resolution, hyper-resolution.
18. Fuzzy sets, fuzzy numbers and arithmetic, discrete fuzzy sets, fuzzy set modifiers (hedges).
19. Fuzzy approximation models, fuzzy (F) transform, fuzzy cluster analysis.
20. Fuzzy inference, compositional rule of inference (CRI), fuzzy rules - Mamdani type, Sugeno-Takagi type, linguistic variable, Zadeh approach, fuzzification / defuzzification, fuzzy inference systems, fuzzy controllers (linear fuzzy proportional-integral-derivative (PID) and incremental control).
2-AIN-138/16 Discrete Structures in Informatics and Computer Graphics - T. Jajcayová
21. Groups, cyclic groups, modular arithmetic, primitive root, application to pseudorandom number generator, linear congruent generator.
22. One-way functions, discrete logarithm, application to Diffie-Helman key exchange protocol, use in crypto systems with public key.
23. Matrix algebra, modular matrices, applications, determinants, linear transformations.
24. Quaternions and their basic operations, Quaternion group, connections to linear transformations and rotations in three dimensions, comparing properties of the fields of Real, Complex, and Quaterion numbers.
25. Number theory, prime tests (also probabilistic), extended Euclidean algorithm - applications, fast modular exponentiation (even with complexities), small Fermat's theorem, Euler's theorem, applications to RSA crypto system.

Recommended literature:

Image processing, analysis, and machine vision / Milan Sonka, Vaclav Hlavac, Roger Boyle. [Stamford] : Cengage Learning, 2008
Artificial intelligence : A modern approach / Stuart J. Russell, Peter Norvig. Englewood Cliffs : Prentice-Hall, 1995

Parallel program design : A Foundation / K. Mani Chandy , Jayadev Misra. Reading : Addison-Wesley, 1988
Hughes et al. 2013. Computer Graphics Principles and Practice. > ISBN-13: > 978-0321399526. Addison-Wesley Professional. 3 edition (July 20, 2013)

Languages necessary to complete the course:
Slovak, English

Last change: 18.03.2026

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KMANM/2-AIN-114/14	Multidimensional analysis and numerical mathematics

Educational activities:
Type of activities: course
Number of hours:
per week: 4 **per level/semester:** 52
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 1.

Educational level: II.

Prerequisites:

Antirequisites: FMFI.KMANM/2-MPG-243/15

Course requirements:
Regular assessment (100% =90 points): 3 tests 15 points each, 9 individual tasks 5 points each
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Students should know the methods and tools for numerical computations required in a computer graphics (physical modeling and animation, global illumination problem, specific modeling), after completing the course.

Class syllabus:
The computational model in numerical mathematics. Numerical stability and robustness, error analysis. Approximation theory. Numerical algebra. Solving large systems of linear equations. Finding roots of nonlinear equations. Numerical differentiation and integration. Optimization - formulation challenges the foundations of convex analysis, numerical methods used to find minima - Gradient methods. Finite Difference Method and Finite Element Method. Introduction to numerical solution of equations diferencálnych. Libraries of numerical methods and work with them.

Recommended literature:
Numerická matematika pre informatika : Riešené príklady v programe Mathematica / Roman Ďurikovič, Vladimír Ďurikovič. Trnava : Univerzita sv. Cyrila a Metoda, 2011
Numerické metódy / Jela Babušíková, Marián Slodička, Juraj Weisz. Bratislava : Univerzita Komenského, 2000

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 323

A	B	C	D	E	FX
24,15	9,6	18,89	18,89	22,6	5,88

Lecturers: Mgr. Jela Babušíková, PhD.

Last change: 21.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-IKV-189/16	Natural Language Processing

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 4.

Educational level: II.

Prerequisites:

Course requirements:

Learning outcomes:
The students will acquire knowledge and practical experience in the field of natural language processing. They will know how to effectively apply the underlying theory from probability, statistics, computational linguistics, and machine learning, to perform tasks involving unstructured text, such as spelling correction, text generation, sentiment analysis, information extraction, and question answering.

Class syllabus:
(1) Text Processing.
(2) Language Modeling (n-grams), Spelling Correction.
(3) Text Classification (Naive Bayes), Sentiment Analysis.
(4) Named Entity Recognition (HMM, MaxEnt), Relation Extraction.
(5) POS Tagging, Parsing.
(6) Information Retrieval.
(7) Meaning Extraction, Question Answering.

Recommended literature:
Speech and Language Processing, 2nd Edition / Daniel Jurafsky, James H Martin. Upper Saddle River : Prentice Hall, 2008

Languages necessary to complete the course:
English

Notes:

Past grade distribution
Total number of evaluated students: 68

A	B	C	D	E	FX
72,06	13,24	10,29	1,47	2,94	0,0

Lecturers: Mgr. Marek Šuppa

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University 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:** 26 / 26
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 during the semester.
Final written-oral exam
Scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 70/30

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 Python.

Class syllabus:
Introduction, inspiration from biology, brief history, NS with logical neurons.
Binary / continuous perceptron: the concept of learning with the teacher, classification of patterns.
Single-layer NS: linear self-association, classification, error functions.
Multilayer perceptron: error backpropagation method, training and test set, generalization, model selection, validation.
Modifications of gradient methods, second order optimization, regularization. Optimization problems.
Unsupervised learning, feature extraction, principal component analysis, self-organizing map, data visualization.
Sequence data modeling: forward NS, relation to n-grams, partially and completely recurrent models, SRN model, BPTT algorithms, RTRL.
Expansion of hidden representation: NS with radial basis functions (RBF), echo state network (ESN).
Deep learning, convolutional neural networks: introduction.
Modern recurrent NS: autoencoders, GRU, LSTM.
Hopfield model: deterministic dynamics, attractors, autoassociative memory.

Stochastic recurrent NS models: basics of probability theory and statistical mechanics, Boltzmann machine, RBM model, Deep Belief Network.
The recent trends in 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.
Goodfellow I., Bengio Y., Courville A. (2016). Deep Learning. MIT Press.
Zhang A. et al. (2020). Dive into Deep Learning. An interactive deep learning book with code, math, and discussions, based on the NumPy interface.

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 223

A	B	C	D	E	FX
26,91	18,39	15,7	10,31	12,56	16,14

Lecturers: prof. Ing. Igor Farkaš, Dr.

Last change: 18.11.2021

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-286/22	Ontologies and Knowledge Engineering

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 5

Recommended semester: 3.

Educational level: I., II.

Prerequisites:

Antirequisites: FMFI.KAI/2-AIN-286/15

Course requirements:
Semester: project (60pts), ongoing work assessment (20pts)
Exam: written exam (20pts)
Min. passing requirements: 50% from the semester and 50% from the exam
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 80/20

Learning outcomes:
Students become acquainted with ontologies, with their role in data representation and sharing, with ontological representation and query languages, and with ontology engineering methodologies. They will also get acquainted with Semantic Web standards and with the principles and possibilities of publishing data in the Linked Open Data network, as well as the use of such data in knowledge-based applications.

Class syllabus:
- Ontologies and their applications
- Well-known ontologies
- Ontological representation languages (RDF, RDF Schema, OWL)
- Ontologies and databases
- SPARQL query language
- Linked Open Data network
- Ontology engineering
- Applications of ontologies in informatics

Recommended literature:
Staab, S. and Studer, R. eds., 2010. Handbook on ontologies. Springer Science & Business Media.
Allemang, D. and Hendler, J., 2011. Semantic web for the working ontologist: effective modeling in RDFS and OWL. Elsevier.
Selected relevant recent scientific papers.

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 28

A	B	C	D	E	FX
64,29	28,57	3,57	3,57	0,0	0,0

Lecturers: doc. RNDr. Martin Homola, PhD., Mgr. Júlia Pukancová, PhD.

Last change: 30.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-MXX-132/23	Participation in Empirical Research

Educational activities:
Type of activities: course
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 2., 8.

Educational level: I., I.II., 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: 202

A	B	C	D	E	FX
89,6	1,49	1,49	0,0	2,97	4,46

Lecturers: Mgr. Xenia Daniela Poslon, PhD.

Last change: 06.09.2023

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-MXX-132/23	Participation in Empirical Research

Educational activities:
Type of activities: course
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1., 7.

Educational level: I., I.II., 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: 202

A	B	C	D	E	FX
89,6	1,49	1,49	0,0	2,97	4,46

Lecturers: Mgr. Xenia Daniela Poslon, PhD.

Last change: 06.09.2023

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTV/2-MXX-110/00	Physical Education and Sport (1)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1., 7.

Educational level: I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:

Class syllabus:
Practicing of the students´ game skills in collective sports: basketball, volleyball, football, floorball and hockey. Mastering of the basic technique of a particular sport discipline in other sports. In paddling, basic training on still and slightly flowing water. Development of coordination skills, improvement of articular mobility and cardiovascular system.

Recommended literature:

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 2007

A	B	C	D	E	FX
97,41	0,6	0,1	0,0	0,0	1,89

Lecturers: PaedDr. Dana Mašlejová, Mgr. Ladislav Mókus, Mgr. Jana Leginusová, Mgr. Tomáš Kuchár, PhD., PaedDr. Mikuláš Ortutay, Mgr. Martin Dovičák, PhD., Mgr. Júlia Raábová, PhD., Mgr. Branislav Nedbálek, PhD., Mgr. Tomáš Lovecký, Mgr. Martina Maheľová, PaedDr. Lucia Ondrušová

Last change: 15.03.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTV/2-MXX-120/00	Physical Education and Sport (2)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 2., 8.

Educational level: I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:

Class syllabus:
Practicing of offensive and defensive game combinations and playing with modified rules in collective sports such as basketball, volleyball, football, floorball, hockey. Command of elements of higher difficulty in locomotion skills (swimming - crawl stroke, breast stroke, butterfly stroke, trampoline jumping and aerobics – practicing of areobics compositions, bodybuilding – development of the main muscle groups, paddling on running water. Testing of the level of physical fitness and coordination skills.

Recommended literature:

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 1797

A	B	C	D	E	FX
98,44	0,33	0,06	0,06	0,06	1,06

Lecturers: Mgr. Martin Dovičák, PhD., Mgr. Tomáš Kuchár, PhD., Mgr. Jana Leginusová, PaedDr. Dana Mašlejová, Mgr. Ladislav Mókus, Mgr. Branislav Nedbálek, PhD., PaedDr. Mikuláš Ortutay, Mgr. Júlia Raábová, PhD., Mgr. Tomáš Lovecký, Mgr. Martina Maheľová, PaedDr. Lucia Ondrušová

Last change: 15.03.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTV/2-MXX-210/00	Physical Education and Sport (3)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 3., 9.

Educational level: I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:

Class syllabus:
To improve offensive and defensive game combinations in collective sports. Practicing of tactical and technical elements in individual sports. Compensatory exercises to correct wrong body posture. Stretching. Competition rules in sport disciplines.

Recommended literature:

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 1525

A	B	C	D	E	FX
98,36	0,39	0,07	0,0	0,07	1,11

Lecturers: PaedDr. Dana Mašlejová, Mgr. Ladislav Mókus, Mgr. Jana Leginusová, Mgr. Tomáš Kuchár, PhD., PaedDr. Mikuláš Ortutay, Mgr. Martin Dovičák, PhD., Mgr. Júlia Raábová, PhD., Mgr. Branislav Nedbálek, PhD., Mgr. Tomáš Lovecký, Mgr. Martina Maheľová, PaedDr. Lucia Ondrušová

Last change: 15.03.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTV/2-MXX-220/00	Physical Education and Sport (4)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 4., 10.

Educational level: I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:

Class syllabus:
Sport training for Faculty Championships in a selected sport with modified rules. Selection of sport-talented students into teams of the Faculty Sport League, University League of Bratislava Faculties, and participation in sport events of the Faculty and University.

Recommended literature:

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 1267

A	B	C	D	E	FX
98,34	0,39	0,08	0,08	0,08	1,03

Lecturers: PaedDr. Dana Mašlejová, Mgr. Ladislav Mókus, Mgr. Jana Leginusová, Mgr. Tomáš Kuchár, PhD., PaedDr. Mikuláš Ortutay, Mgr. Martin Dovičák, PhD., Mgr. Branislav Nedbálek, PhD., Mgr. Júlia Raábová, PhD., Mgr. Tomáš Lovecký, Mgr. Martina Maheľová, PaedDr. Lucia Ondrušová

Last change: 15.03.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University 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 / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Evaluation: assignments, homeworks,
Exam: final exam, oral exam
Evaluation scale: A 92%, B 84%, C 76%, D 68%, E 60%
For the semester, the student can get 10% for exercises, 60% for homework, final written exam with a weight of 30% oral final exam is voluntary with a weight of 20%. The student must solve at least 30% of each homework in order to pass the final written exam. Grading: 92-100 A, 84-91 B, 76-83 C, 68-75 D, 60-67 E. Details on the course page.
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:

Slovak, English

Notes:

Past grade distribution

Total number of evaluated students: 572

A	B	C	D	E	FX
28,85	18,53	16,08	14,69	9,97	11,89

Lecturers: prof. RNDr. Roman Ďurikovič, PhD.

Last change: 20.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-290/15	Practice

Educational activities:
Type of activities: practice
Number of hours:
per week: **per level/semester:** 150s
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 4.

Educational level: II.

Prerequisites:

Course requirements:
Continuous assessment: Attendance, activity report
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
The student will find a suitable company or scientific institution that works in the field of information technology, acquire basic work habits and gain experience in the field of informatics, which is necessary for easier job search. Completing a course with a good recommendation will allow the student to work after graduation.

Class syllabus:
924 / 5000
Translation results
The student will find a suitable company or scientific institution that works in the field of information technology and submit his proposal for approval to the guarantor. The student completes the course according to the instructions of the institution.
The aim of the course is for students to get acquainted with new IT technologies, devices, learn to work with them, operate and operate them.
As a condition for obtaining the evaluation, the student prepares and submits a written report confirmed by the responsible leader in the institution consisting of:
1. Confirmations of attendance of at least 150 hours lasting 9 weeks, i. attendance sheets
2. Activity report or statement sheets with a precise description of the activities
The evaluation for the internship, the minimum duration of which is 9 weeks (150 hours), is recorded by the guarantor after its completion. The internship can be completed at any time during the 1st and 2nd year of the master's study, but no later than the deadline set by the end of the examination period of the given semester.

Recommended literature:

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 221

A	B	C	D	E	FX
50,23	8,14	33,03	3,17	0,45	4,98

Lecturers: prof. RNDr. Roman Ďurikovič, PhD.

Last change: 18.11.2021

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-118/14	Programming in operating systems

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 1.

Educational level: II.

Prerequisites:

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

Learning outcomes:
After completing the course, students will be able to create a low-level system programs and services that communicate directly with the operating system or hardware. Get an overview of the interfaces between the operating system and the user and the access code and techniques for creating system programs.

Class syllabus:
System call, communication with the hardware, work with file systems, networks; run programs, dynamic link libraries, processes and threads, synchronization mechanisms; system services (services), security (authentication, authorization, protection against failures and attacks) vs userspace kernelspace, driver (driver module)

Recommended literature:
Modern operating systems / Andrew S. Tanenbaum. Upper Saddle River : Prentice Hall International, 2001

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 177

A	B	C	D	E	FX
31,64	19,21	22,03	13,56	3,39	10,17

Lecturers: RNDr. Jozef Šiška, PhD., doc. RNDr. Damas Gruska, PhD.

Last change: 18.11.2021
Approved by: prof. RNDr. Roman Ďurikovič, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-109/22	Programming of Parallel and Distributed Systems

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 3 / 1 **per level/semester:** 39 / 13
Form of the course: on-site learning

Number of credits: 5

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
all homeworks as well as two written test during semester has to be completed
A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 80/20

Learning outcomes:
Graduates of the course will be acquainted with the issues of parallel and distributed programming. They will get acquainted with the basic algorithms used in practice, as well as with methods how to prove the correctness or effectiveness of algorithms. They will gain an overview of basic parallel and distributed architectures, a brief overview of various paradigms and programming languages.

Class syllabus:
At the beginning, students will be introduced to a simple way to write algorithms for parallel and distributed computing, so that these notations are applicable to different types of architectures. They will also gain the basics of logic that will be used to express and prove the properties of programs. Then they will get acquainted with the basic architectures of parallel and distributed systems. The core of the course consists of selected basic algorithms of parallel and distributed systems (eg Shortest path, Reader-problémWriters problem, Evening philosophers, Meeting coordination, Drinking philosophers, Sorting, Faulty channels, Global snapshots, Stable feature detection, Byzantine agreement). Alternatively, their zones may expand in line with developments in the field. At the end of the course there will be an overview of different programming languages and paradigms and logics.

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: 387					
A	B	C	D	E	FX
26,87	16,28	22,74	21,45	8,79	3,88
Lecturers: doc. RNDr. Damas Gruska, PhD.					
Last change: 20.06.2022					
Approved by: prof. RNDr. Roman Ďurikovič, PhD.					

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-923/22	Project Seminar (1)

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 5

Recommended semester: 2.

Educational level: II.

Prerequisites:

Course requirements:
The necessary condition for enrolling in the course is the enrollment of the diploma topic and the supervisor.
Interim evaluation: 1. Presentation of their progress on the topic of the diploma thesis and a conference of results within the course. 2. Demonstration of either partially functional implementation or the solution proposed by the graduate and the proposed method of validation (in the case of theoretical, review papers). 3. Evaluation of key studied articles and satisfactory answer to the question from the knowledge of the read literature.
Exam: A: Prototype demonstration, studied basics of the issue. B: A simple example of a partial solution to one of the goals. C: Detailed study of the problem and the procedure of solving the goals, knowledge of the limitations of the studied methods, number of articles (& gt; 4). D: Studied tutorials, new libraries needed to solve the goal. E: The researcher has an idea of how he will specifically solve the goals of the work, he knows which libraries he will use. Fx: remaining options (missing presentation, non-participation)
Indicative assessment scale: A 92%, B 84%, C 76%, D 68%, E 60%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Student will gain habits and experience for individual and collective professional work on a larger scale. They will learn to quickly extract essential ideas from scientific articles. The theoretical part of the diploma thesis will be mastered and will focus on the implementation of the work.

Class syllabus:
1. Presentation of their progress on the topic of the diploma thesis and a conference of results within the subject will take place.
2. Demonstration of either partially functional implementation or the solution proposed by the graduate and the proposed method of validation (in the case of theoretical, review papers).
3. Evaluation of key studied articles and satisfactory answer to the question from the knowledge of the read literature.

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: 395

A	B	C	D	E	FX
61,01	14,68	11,39	2,78	2,78	7,34

Lecturers: prof. RNDr. Roman Ďurikovič, PhD.

Last change: 18.11.2021

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-924/22	Project Seminar (2)

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 5

Recommended semester: 3.

Educational level: II.

Prerequisites: FMFI.KAI/2-AIN-923/22 - Project Seminar (1)

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

Course requirements:
Interim evaluation: 1. Presentation in the form of pre-defense and a conference of results will take place. 2. Written report on the solution in the form of a written comprehensive chapter of the diploma thesis, agreed with the supervisor, front sheets and a list of literature (according to the standard), including documentation (min. 10 pages). 3. Demonstration of either implementation with tests or examples illustrating the solution proposed by the graduate. 4. Study of key articles read and a satisfactory answer to a question from the knowledge of the literature read.
Exam: Rating E and better requires to meet each of the following points.
Indicative assessment scale: A 92%, B 84%, C 76%, D 68%, E 60%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
He will gain habits and experience for individual and collective professional work on a larger scale. They will learn to quickly extract essential ideas from scientific articles. The theoretical part of the diploma thesis will be mastered and will focus on the implementation of the work.

Class syllabus:
Information on large-scale professional work technology. Customs for writing professional computer texts. The second stage of the project is a diploma thesis. Papers of graduates on the issue of diploma thesis. Project work and implementation so that it results in a 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: 422					
A	B	C	D	E	FX
56,16	16,35	11,14	3,55	5,21	7,58
Lecturers: prof. RNDr. Roman Ďurikovič, PhD.					
Last change: 18.11.2021					
Approved by: prof. RNDr. Roman Ďurikovič, PhD.					

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-128/15	Real-time Graphics and GPU Computations

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2.

Educational level: II.

Prerequisites:

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

Course requirements:
The student can get 70% of the evaluation for the project. The student must elaborate the project of at least 50% in order to pass the final oral exam. Grading: 92-100 A, 84-91 B, 76-83 C, 68-75 D, 60-67 E. More detailed informations on the course page.
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:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 46

A	B	C	D	E	FX
36,96	28,26	8,7	6,52	8,7	10,87

Lecturers: Mgr. Andrej Mihálik, PhD.

Last change: 22.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-IKVa-194/21	Reinforcement Learning

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 5

Recommended semester: 2., 4.

Educational level: II.

Prerequisites:

Course requirements:
Work on exercises (50%)
Exam: test (50%)
Grade A: 90% , B: 80% , C 70%, D 60% and grade E at minimum 50%

Learning outcomes:
The graduate will gain an overview of the methods and techniques used in reinforcement learning. Will gain practical experience with analysis, design and implementation of reinforcement learning problems.

Class syllabus:
1. Introduction to reinforcement learning
2. Markov decision process
3. Dynamic programming
4. Monte Carlo methods
5. Temporal-Difference learning
6. Exploration and exploitation
7. Value function approximation
8. Policy gradient methods
9. Actor-critic methods
10. Deep reinforcement learning

Recommended literature:
Sutton, Richard S., and Andrew G. Barto. Reinforcement learning: An introduction. MIT press, 2018.
Goodfellow, Ian, Yoshua Bengio, and Aaron Courville. Deep learning. MIT press, 2016.

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution Total number of evaluated students: 26					
A	B	C	D	E	FX
38,46	30,77	11,54	3,85	7,69	7,69
Lecturers: doc. Ing. Peter Lacko, PhD.					
Last change: 12.11.2021					
Approved by: prof. RNDr. Roman Ďurikovič, PhD.					

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-161/00	Russian Language (1)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1., 7.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Basic communication in Russian, developing other Russian language skills - listening comprehension, reading and writing.

Class syllabus:
To master the fundamentals of general Russian. The language level is A1.
Learning the Cyrillic (Russian) alphabet, gaining basic language competence, building up skills and confidence in dealing with unfamiliar authentic and semi-authentic texts.
The subject provides a course in Russian language for beginners.

Recommended literature:
The textbook: : Точка Ру A1 (Ольга Долматова, Екатерина Новачац), pracovné karty Падежи 1 (Л.С. Безкоровайная, В.Е. Штыленко).

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 746

A	B	C	D	E	FX
57,77	16,62	11,13	4,16	1,74	8,58

Lecturers: Viktoria Mirsalova

Last change: 20.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-162/00	Russian Language (2)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 2., 8.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Basic communication in Russian, developing other Russian language skills - listening comprehension, reading and writing.

Class syllabus:
To master the fundamentals of general Russian.
Learning the Cyrillic (Russian) alphabet, gaining basic language competence, building up skills and confidence in dealing with unfamiliar authentic and semi-authentic texts.
The subject continues the program of Russian language (1) and provides a course of Russian for beginners.

Recommended literature:
Textbook: Точка Ру A1 (Ольга Долматова, Екатерина Новачац), pracovné karty Падежи 1 (Л.С. Безкоровайная, В.Е. Штыленко).

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 435

A	B	C	D	E	FX
63,91	16,09	8,97	3,91	0,92	6,21

Lecturers: Viktoria Mirsalova

Last change: 20.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-261/00	Russian Language (3)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 3., 9.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Basic communication in Russian, developing other Russian language skills - listening comprehension, reading and writing.

Class syllabus:
Learning the handwritten Russian (Russian Cursive Cyrillic), developing further language skills, gaining knowledge of Russian culture, history and way of life, pre-intermediate to intermediate grammar and vocabulary.
The course "Russian for Intermediate Students" is a follow-up to "Russian for Beginners". The subject of the course is general Russian in the range appropriate to the given level.

Recommended literature:
Точка Ру A2 (Ольга Долматова, Екатерина Новачац) a Short Stories in Russian (Olly Richards, Alex Rowlings)

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 215

A	B	C	D	E	FX
68,84	17,67	9,3	2,33	0,0	1,86

Lecturers: Viktoria Mirsalova

Last change: 20.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-262/00	Russian Language (4)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 4., 10.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Learning the handwritten Russian (Russian Cursive Cyrillic), developing further language skills, gaining knowledge of Russian culture, history and way of life, pre-intermediate to intermediate grammar and vocabulary.

Class syllabus:
Learning the handwritten Russian (Russian Cursive Cyrillic), developing further language skills, gaining knowledge of Russian culture, history and way of life, pre-intermediate to intermediate grammar and vocabulary.
The course "Russian for Intermediate Students" is a follow-up to "Russian for Beginners". The subject of the course is general Russian in the range appropriate to the given level.

Recommended literature:
Точка Ру A2 (Ольга Долматова, Екатерина Новачац) a Short Stories in Russian (Olly Richards, Alex Rowlings)

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 153

A	B	C	D	E	FX
74,51	14,38	7,19	2,61	0,65	0,65

Lecturers: Viktoria Mirsalova

Last change: 20.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-IKVa-192/19	Science, Technology and Humanity: Opportunities and Risks

Educational activities:
Type of activities: seminar
Number of hours:
per week: 3 **per level/semester:** 39
Form of the course: on-site learning

Number of credits: 5

Recommended semester: 4.

Educational level: I., I.II., II.

Prerequisites:

Course requirements:
Semestral evaluation: active participation
Final evaluation: essay
Weight of the final evaluation: 60%
To achieve an A, 90% is needed, for B at least 80%, for C 70%, for D, 60% and for an E, at least 50% of overall assessment.

Learning outcomes:
The students will gain awareness of the contemporary and potential future challenges posed by scientific and technological innovations and their impact on human behaviour, culture and society.

Class syllabus:
Big data: privacy, politics and power,
Internet of things, it usefulness and threats,
Assistant AI and its place in future society,
Job market and inequality,
Enhancements and human rights and the right to change self and others,
Initiatives for responsible research,
Artificial minds,
Hybridization between species and between AI and organic minds,
Future of minds and trans-humanism,
Artificial emotional intelligence,
An after human era.

Recommended literature:
- S. Russell: Human compatible. Artificial intelligence and the problem of control. Viking, 2019.
- J. Havens: Heartificial intelligence. Embracing our humanity to maximize machines. Penguin, 2016.
- P. Boddington: Towards a code of ethics for artificial intelligence. Springer, 2017.
- M. Shanahan: The technological singularity. MIT Press, 2015.

- C. MacKellar, C.: Cyborg Mind: What Brain–Computer and Mind–Cyberspace Interfaces Mean for Cyberneuroethics. Berghahn Books, 2019.
- G. Bel, J. Gemmell: Total Recall, How the e-Memory Revolution will change everything. Dutton, 2009.
- S. Zuboff: The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power. PublicAffairs, 2019.
- C. O'Neil: Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy. Crown Publishers, 2016.
- M. Tegmark: Life 3.0. Allen Lane, 2017.

Languages necessary to complete the course:
English

Notes:

Past grade distribution
Total number of evaluated students: 146

A	B	C	D	E	FX
40,41	21,92	16,44	6,85	4,79	9,59

Lecturers: doc. RNDr. Martin Takáč, PhD., PhDr. Ing. Tomáš Gál, PhD.

Last change: 28.02.2020

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-211/22	Shader Programming

Educational activities:
Type of activities: course
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 4.

Educational level: II.

Prerequisites:

Course requirements:
To obtain an A rating it is necessary to obtain at least 90% of points, to obtain a B rating at least 80% of points, for rating C at least 70% of points, for rating D at least 60% of pointsand for rating E at least 50% of the points.
Scale of assessment (preliminary/final): Weight of the course work / exam: Weight of the intermediate / final evaluation: 100/0

Learning outcomes:
Students will learn to program the shader programs used in computer graphics to create a variety of effects in image rendering. Student will be able to use the learned principles during programming of the graphics effects in game engines or interfaces such as Vulkan or OpenGL.

Class syllabus:
Learning in online editor Shadertoy.
2D and 3D transformations.
Procedural modeling.
Parametric equations.
Procedural textures.
Fractal generation.
Particle systems.
Team work on a project in a PC room, brainstorming

Recommended literature:
Graphics Shaders: Theory and Practice, Second Edition / Mike Bailey, Steve Cunningham : CRC Press, 2016

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 2

A	B	C	D	E	FX
100,0	0,0	0,0	0,0	0,0	0,0

Lecturers: Mgr. Andrej Mihálik, PhD.

Last change: 18.11.2021

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-171/20	Slovak Language for Foreign Students (1)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 1., 7.

Educational level: I., I.II., II., III.

Prerequisites:

Course requirements:
tests
Course prerequisites:
https://fmph.uniba.sk/microsites/kjp/katedra-jazykovej-pripravy/poziadavky-na-udelenie-priebezneho-hodnotenia-aj1aj2aj3-ostatne-kurzy/
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
This course is aimed for foreign students to learn the fundamentals of the Slovak language with the focus on basic communication as well as all other language skills- listening comprehension,reading and writing.

Class syllabus:
The sylabus is targeted at the comprehension of the basics of the Slovak language for the absolute beginners (A1).

Recommended literature:
Krížom- Krážom Slovenčina 1, additional material to further support the covered topics.

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 155

A	ABS	B	C	D	E	FX	NEABS
40,65	21,29	7,1	4,52	0,65	1,29	21,29	3,23

Lecturers: Mgr. Aneta Barnes

Last change: 21.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-172/20	Slovak Language for Foreign Students (2)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 2., 8.

Educational level: I., I.II., II., III.

Prerequisites:

Course requirements:
tests
Course prerequisites:
https://fmph.uniba.sk/microsites/kjp/katedra-jazykovej-pripravy/poziadavky-na-udelenie-priebezneho-hodnotenia-aj1aj2aj3-ostatne-kurzy/
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
This course is aimed for foreign students to learn the fundamentals of the Slovak language with the focus on basic communication as well as all other language skills- listening comprehension,reading and writing.

Class syllabus:
The sylabus is targeted at the comprehension of the basics of the Slovak language for the absolute beginners (A1) and this course is a follow up course to the Slovak language course 1.

Recommended literature:
Krížom- Krážom Slovenčina 1, additional material to further support the covered topics

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 87

A	ABS	B	C	D	E	FX	NEABS
63,22	18,39	1,15	1,15	0,0	0,0	9,2	6,9

Lecturers: Mgr. Aneta Barnes

Last change: 21.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-271/20	Slovak Language for Foreign Students (3)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 3., 9.

Educational level: I., I.II., II., III.

Prerequisites:

Course requirements:
tests
Course prerequisites:
https://fmph.uniba.sk/microsites/kjp/katedra-jazykovej-pripravy/poziadavky-na-udelenie-priebezneho-hodnotenia-aj1aj2aj3-ostatne-kurzy/
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
This course is aimed for foreign students to better comprehend all the language skills important to enable correct usage of the Slovak language – listening comprehension, reading, writing and speaking.

Class syllabus:
The sylabus is targeted at the comprehension of all the language skills of the Slovak language , and it is a follow up course to the Slovak language course 2.

Recommended literature:
Krížom-Krážom Slovenčina 2, additional material to further support the covered topics.

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 32

A	ABS	B	C	D	E	FX	NEABS
59,38	3,13	18,75	3,13	3,13	0,0	12,5	0,0

Lecturers: Mgr. Aneta Barnes

Last change: 21.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/1-MXX-272/20	Slovak Language for Foreign Students (4)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 2

Recommended semester: 4., 10.

Educational level: I., I.II., II., III.

Prerequisites:

Course requirements:
tests
Course prerequisites:
https://fmph.uniba.sk/microsites/kjp/katedra-jazykovej-pripravy/poziadavky-na-udelenie-priebezneho-hodnotenia-aj1aj2aj3-ostatne-kurzy/
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
This course is aimed for foreign students to better comprehend all the language skills important to enable correct usage of the Slovak language – listening comprehension, reading, writing and speaking.

Class syllabus:
The sylabus is targeted at the comprehension of all the language skills of the Slovak language , and it is a follow up course to the Slovak language course 3.

Recommended literature:
Krížom-Krážom Slovenčina 2, additional material to further support the covered topics.

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 25

A	ABS	B	C	D	E	FX	NEABS
84,0	0,0	4,0	4,0	0,0	0,0	8,0	0,0

Lecturers: Mgr. Aneta Barnes

Last change: 21.06.2022

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-149/24	Software Analysis Techniques

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2., 4.

Educational level: II.

Prerequisites:

Course requirements:
Continuous assessment: examples from exercises
Examination: oral or written examination
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%
Weight of the intermediate / final evaluation: 40/60
Scale of assessment (preliminary/final): 40/60

Learning outcomes:
The aim of the course is for students to:
1. gain an overview of analysis techniques used in the creation of real software systems;
2. have the opportunity to see examples of the application of these techniques in the field of financial information systems, in particular in banking;
3. be able to actively use the basic of these techniques and create analytical models.
The course will show simplified and abstracted models from real software projects.
The course is intended primarily for students who do not associate their future with the creation of program code, but want to work as software analysts in major companies, whether in software companies or in customer companies such as banks, insurance companies or telecommunications operators. Thanks to the combination of the abstraction ability that FMFI students have acquired during their studies to date with a quality foundation of programming, FMFI graduates have a significant competitive advantage over graduates of other computer science faculties in the positions of software analyst.
The lecturer works as a chief analyst in a software company. He was a senior analyst for several software projects for large companies, such as Tatra banka, VUB banka, ČSOB banka, Volksbank Slovensko, VIG group insurance companies and others.

Class syllabus:
Within the course we will focus on the following groups of techniques and models:
1. Techniques and models of software analysis: use cases, UML, BPMN.
2. Techniques, methods and models of enterprise architecture: ArchiMate, TOGAF.
3. Techniques of business analysis: prioritization of requirements, cost-benefit analysis, interview, workshop and more.

Brief syllabus of lectures:
1. Use cases - Functional specification of systems. Types and forms of use cases.
2. BPMN - Language for process modeling. Example of approving mortgage loans in a bank.
3. UML class diagram - Advanced data modeling techniques. General analytical data patterns.
4. Analytical data patterns for banking: Accounts and transactions. Bank loans.
5. Analytical data patterns for insurance: Insurance contracts. Insurance products.
6. UML sequence diagram - Modeling of systems / objects communication.
7. ArchiMate - Language for enterprise architecture modeling.
8. Archimate - Architectural views. An example of enterprise mortgage modeling.
9. Typical examples of software systems in the bank and in the insurance company. Modeling their integration
architecture in ArchiMate.
10. TOGAF - Enterprise architecture development standard
11. BABOK - World standard of business analysis.
12. Selected techniques of business analysis: SWOT, MoSCoW, CBA, mind maps, interview, workshop
Examples of models solved in exercises:
1. Bank Branch Cash Management (UML) Modeling
2. Payment cards, digitization of payment cards (UML, ArchiMate)
3. Approval of corporate loans in the bank (BPMN)
4. Motor Insurance Insurance Modeling (UML)
5. Modeling of commissions in the insurance company (UML)
6. Enterprise corporate loan model (ArchiMate)

Recommended literature:

Základná:
Šešera, Ľ.: Aplikačné architektúry softvérových systémov. STU v Bratislave FIIT, 2010. 276 s. ISBN 978 80 227 3245 1.
Slajdy z prednášok.
Odporúčaná:
Bittner, K., Spence, I.: Use Case Modeling. Addison Wesley. 2002.
Lankhorst, M.: Enterprise Architecture at Work: Modelling, Communication and Analysis, 4th Edition, Springer 2017.
Cadle J., Debra P., Turner, P.: Business Analysis Techniques: 123 essential tools for success. 3nd Edition. British Computer Society 2021.
Object Management Group: The Business Process Model and Notation (BPMN) specification. Version 2.0.2. 2013. https://www.omg.org/spec/BPMN/2.0.2/PDF.
The Open Group: ArchiMate 3.1 Specification. https://publications.opengroup.org/standards/archimate/c197.
The Open Group: The TOGAF standard – Version 9.2. https://publications.opengroup.org/standards/togaf/c182
International Institute of Business Analysis: A Guide to the Business Analysis Body of Knowledge®
(BABOK® Guide) version 3. 2015.

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 43

A	B	C	D	E	FX
41,86	30,23	13,95	6,98	4,65	2,33

Lecturers: RNDr. Ľubor Šešera, PhD.

Last change: 12.08.2024

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KDMFI/2-AIN-115/15	Software for Education

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Continuous assessment: work at excercises, review software, written test, two projects
Approximate evaluation scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 75/25

Learning outcomes:
Students are able to assess the suitability of a particular educational software for teaching informatics at the elementary and secondary schools, respectively at university. They are able to classify educational software. They can give examples of software that is suitable for training for a specific age group of students. They can review educational software and are able to apply the basics of software engineering of educational software. In a team they write a specification for educational software project and they implement a working prototype of it.

Class syllabus:
The importance of digital technologies in the cognitive process, in teaching and learning.
Definition and classification of pedagogical software, criteria of its evaluation.
Educational applications for teaching computer science to primary and secondary school students.
Information systems used for education.
Software for education and developmental stages of knowledge.
GUI design and use of HCI in educational software programming.
Multimedia and their place in the cognitive process. Action research - students and teachers as co-authors of software design for education.
Principles of creating software for education.
Educational software for students with special needs.

Recommended literature:
Transformations of the school in the digital age / Ivan Kalaš and team. Bratislava: Slovenské pedagogické nakladateľstvo - Mladé letá, 2013
T. Plomp, N. Nieveen et al. Educational Design Research. Slo 2013
own electronic texts published on the website, resp. in the Moodle environment

Languages necessary to complete the course:

Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 148

A	B	C	D	E	FX
32,43	22,3	23,65	10,14	4,05	7,43

Lecturers: doc. PaedDr. Monika Tomcsányiová, PhD., Mgr. Lucia Budinská, PhD., Mgr. Mária Čujdíková, PhD.

Last change: 16.11.2021

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTV/2-MXX-115/17	Sports in Natur (1)

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

Number of credits: 2

Recommended semester: 1., 7.

Educational level: I.II., II.

Prerequisites:

Course requirements:
Grades: A 90%, B 80%, C 70%, D 60%, E 50%
The condition for the award of 1 or 2 credits is the completion of a multi-day course in its full scope, or the completion of one-day courses in the scope of 4 days. Candidates can apply to the leaders of individual courses. From the presented offer of courses, you can choose the one that suits your interests, abilities and deadlines.

Learning outcomes:
Acquisition and development of basic motor skills and abilities in selected sports: skiing and snowboarding. Mastering the correct technique of performing individual movements, which are necessary for skiing and snowboarding.

Class syllabus:
The student can sign up for the outdoor sports courses offered by the department: skiing, snowboarding. The lessons in the courses are focused on the development of basic and special movement skills and mastering the techniques needed for the sports.

Recommended literature:

Languages necessary to complete the course:
Slovak

Notes:
KTVŠ does not rent ski equipment.

Past grade distribution
Total number of evaluated students: 186

A	B	C	D	E	FX
98,92	0,0	0,0	0,0	0,0	1,08

Lecturers: Mgr. Martin Dovičák, PhD., Mgr. Tomáš Kuchár, PhD., Mgr. Jana Leginusová, PaedDr. Dana Mašlejová, Mgr. Ladislav Mókus, PaedDr. Mikuláš Ortutay, Mgr. Júlia Raábová, PhD., Mgr. Tomáš Lovecký

Last change: 16.06.2022
Approved by: prof. RNDr. Roman Ďurikovič, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTV/2-MXX-116/18	Sports in Natur (2)

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

Number of credits: 2

Recommended semester: 2., 8.

Educational level: I.II., II.

Prerequisites:

Course requirements:
Grades: A 90%, B 80%, C 70%, D 60%, E 50%.
The condition for the award of 1 or 2 credits is the completion of a multi-day course in its full scope, or the completion of one-day courses in the scope of 4 days. Candidates can apply to the leaders of individual courses. From the presented offer of courses, you can choose the one that suits your interests, abilities and deadlines.

Learning outcomes:
Creating a positive and lasting relationship with physical activity. Acquisition and mastery of basic motor skills and abilities in outdoor sports: windsurfing, beach volleyball, water tourism - river rafting, hiking and other sports according to interest. Training and improving the technique needed for the sports.

Class syllabus:
The student can sign up for the outdoor sports courses offered by the department: water tourism - river rafting, windsurfing, beach volleyball, hiking and other hobby sports. The lessons in the courses are focused on the development of basic and special movement skills and, mastering the techniques needed for the sports.

Recommended literature:

Languages necessary to complete the course:
Slovak

Notes:
KTVŠ will provide sports equipment.

Past grade distribution
Total number of evaluated students: 109

A	B	C	D	E	FX
95,41	0,0	0,0	0,0	0,0	4,59

Lecturers: Mgr. Martin Dovičák, PhD., Mgr. Tomáš Kuchár, PhD., Mgr. Jana Leginusová, PaedDr. Dana Mašlejová, Mgr. Ladislav Mókus, PaedDr. Mikuláš Ortutay, Mgr. Júlia Raábová, PhD., Mgr. Tomáš Lovecký
Last change: 16.06.2022
Approved by: prof. RNDr. Roman Ďurikovič, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-137/24	Statistical Methods in Artificial Intelligence

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2.

Educational level: II.

Prerequisites:

Antirequisites: FMFI.KAI/2-AINa-137/20

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. Short repetition of basic technics in AI: agent, searching, CSP problem, logical agents.
2. Planning I: Basic planning (STRIPS, POP, TOP, graphplan, critical path method), scheduling.
3. Planning II: Planning problems (hierarchical planning, senzorless planning, incremental planning, planning in a case of nondeterministic actions.)
4. Probabilistic methods in UI I: necessary basic concepts (short summary), introduction to Monte Carlo methods, basic examples. Sampling methods in MC, MC in AI (sampling and artificial data, Monte Carlo tree search)
5. Probabilistic methods in UI II: bayesian networks, bayesian inference, examples. Exact and probabilistic inference in bayesian networks: derect and rejection sampling, likehood weighting, how to use bayesian networks in UI (classification, diagnosis)
6. Time series I . Classical time series analysis, trend and periodicity analysis, spectral analysis, stationary time series, nonlinear time series.
7. Time series II. Box Jenkins time series analysis (AR, MA, ARMA models), time series with uncertainity, introduction.
8. Time series III. Time series with uncertainity, markovian processes, filtration, prediction, Vitterbi algorithm, real problem examples, Kálman filter.
9. Decision theory I. Introduction, simple and complex decisions (lottery examples) utility functions. Markov decision problem, optimal policy, value iteration algorithm, Belman equation.

10. Decision theory II. Decision in games, dominant strategy , Nash equilibrium, repeated games, grim trigger a tit for tat analysis. Cooperation in games.
11. Theory of learning I : supervised and unsupervised learning, Learning decision trees, PAC learning, linear models, regression and classification.
12. Theory of learning II : Bayesian learning , naive models, maximum likehood learning and continuous models, Bayesian learning with hidden parameters.

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:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 15

A	B	C	D	E	FX
6,67	20,0	20,0	26,67	26,67	0,0

Lecturers: doc. RNDr. Mária Markošová, PhD.

Last change: 28.05.2024

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-142/25	Trustworthy and Explainable AI

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 2., 4.

Educational level: II.

Prerequisites:

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

Learning outcomes:
After completing this course, students will have a solid understanding of key concepts such as explainability, trustworthiness, and transparency in machine learning applications, and how these relate to the broader field of ethical AI. In addition, they will gain hands-on experience implementing some of the most widely used algorithms designed to enhance these qualities in both symbolic and subsymbolic AI systems.

Class syllabus:
- Trustworthy & Eplainable AI
- Subsymbolic, symbolic and neuro-symbolic AI
- Robustness & Adversarial attacks
- Post-hoc methods – explaining the black-box (LIME, SHAP, Saliency maps)
- Intrinsic methods – explainable by design
- Symbolic methods (Regression & rule-learning, abduction, social choice, argumentation)
- Hybrid methods (DeepProbLog, Activation Pattern Recognition, KB Embedding)
- Subsymbolic (Grad-CAM, xDNNs, LEN)

Recommended literature:
Wojciech Samek, Gregoire Montavon, Andrea Vedaldi, Lars Kai Hansen, and Klaus-Robert Muller. 2019. Explainable AI: Interpreting, Explaining and Visualizing Deep Learning (1st. ed.). Springer Publishing Company, Incorporated.
Molnar, C. (2025). Interpretable Machine Learning: A Guide for Making Black Box Models Explainable (3rd ed.). christophm.github.io/interpretable-ml-book/

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 0

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

Lecturers: doc. RNDr. Martin Homola, PhD., Mgr. Štefan Pócoš, PhD.

Last change: 02.09.2025

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-223/24	Virtual and Extended Reality

Educational activities:
Type of activities: course
Number of hours:
per week: 4 **per level/semester:** 52
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
Continuing evaluation: project (30%) and exercise assignments (10%).
Exam: written exam (60%).
To successfully complete the course, student has to obtain at least 50% of points and the project and on the exercise assignments and at least 50% on the final exam.
Scale: A 90%, B 80%, C 70%, D 60%, E 50%.
Scale of assessment (preliminary/final): Continuing evaluation/Exam: 40/60.

Learning outcomes:
After graduating, students will understand the theoretical foundations and practical skills in creating the team applications in enhanced and virtual reality.

Class syllabus:
Definitions and Basic Concepts, Applications in Industry and Culture
Augmented Reality: Definition of Terms, Applications in Industry and Culture
Hardware for Virtual and Augmented Reality (Input and Output Devices)
Case Study of Augmented Reality Application in Industry (Car Design, Data and Process Visualization in
Factories)
Case Study of Virtual Reality Application in Healthcare (Virtual Therapy, Virtual Physiotherapy)
Registration and Tracking in Augmented Reality (Marker, Markerless, RGBD, GPS)
3D Object Reconstruction, Digital Twin
API and Commercial Software for Virtual and Augmented Reality
Modeling and Visualization Software in Virtual Reality

Recommended literature:
Displays: fundamentals & applications / Hainich, Rolf R., and Oliver Bimber: AK Peters/CRC Press, 2016.
Augmented reality: principles and practice / Schmalstieg, Dieter, and Tobias Hollerer: Addison-Wesley Professional, 2016.
Eswaran, M., and MVA Raju Bahubalendruni. "Challenges and opportunities on AR/VR

technologies for manufacturing systems in the context of industry 4.0: A state of the art review." Journal of Manufacturing Systems 65 (2022): 260-278.

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 21

A	B	C	D	E	FX
14,29	19,05	38,1	0,0	23,81	4,76

Lecturers: RNDr. Zuzana Berger Haladová, PhD., doc. RNDr. Martin Madaras, PhD., Mgr. Lukáš Gajdošech, PhD.

Last change: 18.06.2024

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-255/15	Visual Information Processing

Educational activities:
Type of activities: lecture
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning

Number of credits: 3

Recommended semester: 4.

Educational level: II.

Prerequisites:

Course requirements:
Continuous assessment: homework, projects
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
The graduate of the course will master both basic and advanced methods of video processing.

Class syllabus:
• 2D motion estimation, 3D and 2D motion modeling, and basic motion estimation methods, advanced techniques (mesh-based, global motion estimation, multi-resolution approach)
• Video segmentation, spatial and temporal
• Video stabilization, panoramic video generation, debluring
• Noise reduction, Restoration (deblurring), Superresolution, Mosaicing
• Basic compression techniques,
• Video coding: motion compensated prediction and interpolation, block-based hybrid video coding, Scalable coding
• Waveform-based coding: transform coding, predictive coding
• Stereo and multiview video processing
• Video Watermarking
• Video quality assessment

Recommended literature:
High dynamic range video / Karol Myszkowski, Rafal Mantiuk, Grzegorz Krawczyk. [s.l.] : Morgan & Claypool, 2008

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 10

A	B	C	D	E	FX
80,0	20,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Zuzana Černeková, PhD.

Last change: 18.11.2021

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI/2-AIN-120/15	Visual Information Processing - Generic Subject

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

Number of credits: 6

Recommended semester: 1.

Educational level: II.

Prerequisites:

Course requirements:
Continuous assessment: The number of credits and the conditions of fulfillment are given by the rules of the foreign university.
Examination: written, oral
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Ability to keep in touch with the latest developments in their discipline within the subjects. After completing the course, students will learn how to study abroad, make new contacts in their field, on which they can build their professional growth, learn about a new cultural environment, learn how to adapt to a foreign team, improve communication skills.

Class syllabus:
Course in the field of advanced computer graphics and image processing. The course is intended only for students who complete part of their studies at foreign universities as part of study stays on the basis of an agreement. The choice of the subject is subject to the consent of the guarantor of the study program. The number of credits and the conditions of fulfillment are determined by the rules of the foreign university.

Recommended literature:

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 2

A	B	C	D	E	FX
0,0	50,0	50,0	0,0	0,0	0,0

Lecturers: prof. RNDr. Roman Ďurikovič, PhD.

Last change: 18.11.2021
Approved by: prof. RNDr. Roman Ďurikovič, PhD.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAI+KDMFI/2-AIN-111/24	Web Design Methodology

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 1.

Educational level: I., II.

Prerequisites:

Antirequisites: FMFI.KAI+KDMFI/2-AINa-111/20

Course requirements:
Semester: project 60pts, final test 15pts (minimum 50%)
Exam: oral exam 25pts (admittance requirement: 60pts from the semester)
Passing the course: 50pts altogether and 50% from the final test
Scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 75/25

Learning outcomes:
An overview of web technologies and their applications for various purposes. Principles and methodologies of web applications, web user interfaces, and web content design.

Class syllabus:
- Overview of web technologies and web architecture
- Information architecture, types of websites, web applications, components and interfaces
- Client platforms (mobile, tablet, desktop) and implications for web design and development
- Methodologies of website and web application development (waterfall model, agile methodologies)
- Interaction design methodologies (user research and modelling, iterative prototype-based design, prototype testing)
- Principles and methodologies of web content curation
- Testing, optimization and maintenance of web applications and web content
- Website and web application quality measures

Recommended literature:
Web Style Guide, 4th ed. / P.J. Lynch, S. Horton. Yale University Press, 2016. Dostupné online: http://webstyleguide.com/
Mobile First. L. Wroblewski, A Book Apart, 2011

Languages necessary to complete the course:

Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 29

A	B	C	D	E	FX
6,9	20,69	17,24	24,14	17,24	13,79

Lecturers: prof. RNDr. Zuzana Kubincová, PhD., doc. RNDr. Martin Homola, PhD., Mgr. Ján Kľuka, PhD.

Last change: 28.05.2024

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

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KDMFI/2-AIN-224/15	Web Programming

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning

Number of credits: 6

Recommended semester: 3.

Educational level: II.

Prerequisites:

Course requirements:
Intermediate assessment: assignments (50%), project (50%)
Exam: practical (at least 70% of the semester points are needed)
Indicative evaluation scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 20 / 80

Learning outcomes:
The student will be able to create extensive educative web application using databases, respectively. storage and other advanced technologies for the development of dynamic web applications.

Class syllabus:
HTML5 - Canvas, Web Storage, Media, Drag & Drop
JQuery, JQueryUI, Vue.js, or another suitable framework
AJAX - manipulation of objects with their properties (also CSS), effects, event processing, efficient work with forms, etc.
Two-way communication between server and client

Recommended literature:
actual documentation for each technology
w3schools.com
own electronic texts published on the website or in the Moodle environment

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 254

A	B	C	D	E	FX
67,32	11,02	8,66	1,57	3,94	7,48

Lecturers: PaedDr. Roman Hrušecký, PhD., prof. RNDr. Zuzana Kubincová, PhD.

Last change: 21.06.2022
Approved by: prof. RNDr. Roman Ďurikovič, PhD.