CONTENT

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/TZLD/15	**Course name:** Algorithmically unsolvable problems

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: present

Number of ECTS credits: 9

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:

Learning outcomes:
To understand basic notions of algorithmically unsolvable problems, mutual reduction of problems and the grades of unsolvability.

Brief outline of the course:
Variants of halting problems and their algorithmical unsolvability.
Undecidability of the theory of natural numbers, Goedel's a Tarski's theorem.
Relationship between undecidability and completeness.
Algorithmical unsolvability of some mathematical problems.
Diofantesian equations and non-existence of an algorithm for existence of their solutions.
Mutual reduction of problems and the grades of unsolvability.

Recommended literature:
1. BARWISE, J. ed.: Handbook of mathematical logic, North Holland, 1977.
2. KLEENE, S. C.: Introduction to metamathematics, Van Nostrand, 1952.
3. MENDELSON, E.: Introduction to mathematical logic, Van Nostrand, 1963.
4. DAVIS, M.: Hilbert's tenth problem is unsolvable, Amer. Math. Monthly, 1973, pp.233-296.

Course language:

Notes:

Course assessment
Total number of assessed students: 1

N	P
0.0	100.0

Provides: prof. RNDr. Stanislav Krajči, PhD.

Date of last modification: 03.05.2015

Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ SALD/15	**Course name:** Algorithms on strings
Course type, scope and the method: **Course type:** Lecture / Practice **Recommended course-load (hours):** **Per week:** 2 / 0 **Per study period:** 28 / 0 **Course method:** present	
Number of ECTS credits: 8	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 8

N	P
0.0	100.0

Provides: doc. RNDr. Gabriela Andrejková, CSc., prof. RNDr. Stanislav Krajči, PhD.
Date of last modification: 03.05.2015
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ CZC/15	**Course name:** Citation in international scientific journal
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 10	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 15

abs	n
100.0	0.0

Provides:
Date of last modification: 03.05.2015
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ CDC/15	**Course name:** Citation in local scientific journal
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 5	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 0	

abs	n
0.0	0.0

Provides:
Date of last modification: 03.05.2015
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ CM/15	**Course name:** Citation in monograph
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 20	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 0	

abs	n
0.0	0.0

Provides:
Date of last modification: 03.05.2015
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ SDPR/15	**Course name:** Co-worker of a local project
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 2	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 70

abs	n
100.0	0.0

Provides:
Date of last modification: 03.05.2015
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ SMPR/15	**Course name:** Co-worker of an international project
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 15	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Membership in the research team of an international project.	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 19	

abs	n
100.0	0.0

Provides:
Date of last modification: 08.11.2022
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ VYMD/15	**Course name:** Computational complexity and models

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: present

Number of ECTS credits: 9

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Written test combined with an oral examination.

Learning outcomes:
Providing an extended backgroung in the area of efficient computations, computational complexity of algorithms, fundamental time and space complexity classes, hardest complete problems, and about reducibility among problems.

Brief outline of the course:
1. Measuring time and space complexity, basic computational models: single- and multi-tape Turing machines, RAM and RASP models, unit and logarithmic costs.
2. Basic complexity classes: L, NL, P, NP, PSPACE, NPSPACE, EXPTIME, NEXPTIME, EXPSPACE.
3. P versus NP, L versus NL. Examples of complete problems in these classes.
4. Polynomial time and logarithmic space reducibilities, definition and basic properties of complete problems.
5. NP-completenss of the Boolean formula satisfiability (SAT).
6. Variants of SAT, problems related to graph coloring.
7. Other NP-complete problems: vertex cover, Hamiltionian paths, subset sum, balancing, traveling salesman problem.
8. Subexponential deterministic solutions for selected NP-complete problems: planar 3-colorability, balancing. Restricted variants with more efficient solutions.
9. Space complexity classes: Savitch theorem, inductive counting.
10. Problems complete for NL, P, and PSPACE: graph accessibily (GAP), circuit-value, quantified Boolean formulas (QBF).
11. Hierarchy and translation theorems for time and space.
12. Relativized complexity classes.
13. Alternating complexity classes.
14. Polynomial time hierarchy.
15. Alternating logarithmic space hierarchy.

Recommended literature:

J.E. Hopcroft, R.Motwani, J.D. Ullman: Introduction to automata theory, languages, and computation, Addison-Wesley, 2007.
M. Sipser: Introduction to the Theory of Computation, Thomson, 2nd edition, 2006.
S. Arora, B. Barak: Computational Complexity: A Modern Approach, Cambridge Univ. Pess, 2009.
C. Calude and J. Hromkovič: Complexity: A Language-Theoretic Point of View, in G. Rozenberg and A. Salomaa, Handbook of Formal Languages II, Springer, 1997.
G.Brassard, P.Bradley: Fundamentals of algorithmics, Prentice Hall, 1996.
Ch. H. Papadimitriou: Computational Complexity, Addison-Wesley, 1994.
D.P.Bovet, P.Crescenzi: Introduction to the theory of complexity, Prentice Hall, 1994.

Course language:
Slovak or english

Notes:
Content prerequisity: Basic knowlegde in the area of formal languages, automata theory, and programming.

Course assessment
Total number of assessed students: 28

N	P
0.0	100.0

Provides: prof. RNDr. Viliam Geffert, DrSc.

Date of last modification: 23.11.2021

Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/PGOD/15	**Course name:** Computer graphics and image processing

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: 2 / 1 **Per study period:** 28 / 14
Course method: present

Number of ECTS credits: 8

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:

Learning outcomes:
To introduce the basic elements of the visual system, internal and external representations of an image, the image pre-processing methods and applications for surface visual inspection.

Brief outline of the course:
Introduction to computer vision. Collecting and storing images. Capturing and digitizing. Representation of the image - the image space. Color models. Multispectral images. Properties of digital images. Local operations. Global operations. Active contours. Segmentation. Texture, variety of symptoms. 3D reconstruction and visualization. Chaos and fractals.

Recommended literature:
1. ŠONKA, P., HLAVÁČ, V., BOYLE: Image processing, Analysis and Machine Vision, 2nd edition, International Thomson Publishing Inc., 1999.
2. TURCEZAN, M., JAIN, A.K.: Texture analysis. The handbook of pattern recognition and computer vision. World Scientific Pub. Co., 1998.

Course language:

Notes:

Course assessment
Total number of assessed students: 9

N	P
0.0	100.0

Provides: doc. RNDr. Csaba Török, CSc., doc. RNDr. Jozef Jirásek, PhD.

Date of last modification: 03.05.2015

Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/ KRYD/15	**Course name:** Cryptology

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: present

Number of ECTS credits: 9

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Witten and oral exam.

Learning outcomes:
To learn theoretical background and standard methods of computer algebra and know how they can be used in cryptographic systems and cryptoanalytic methods. To know current trends of research in this area of computer science.

Brief outline of the course:
Special parts of computational algebra - rings of polynoms, cyclic groups, factorization of big numbers, arithmetic of eliptic curves. Actual problems of symmetric and nonsymmetric cryptography and cryptoanalysis.

Recommended literature:
1. ROSEN, K. H.: Elementary Number Theory and Its Applications, Addison Wesley, 2000
2. STINSON, D. R. : Cryptography. Theory and Practie, CRC Press, 2002
3. MEZENES, A.,. van Oorschot, P., Vanstone, S.: Handbook of Applied Cryptography, CRC Press, 1996
4. BLAKE, I. F., Seroussi, G., Smart, N.P.: Elliptic Curves in Cryptography, CUP 1999

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 6

N	P
0.0	100.0

Provides: prof. RNDr. Gabriel Semanišin, PhD., doc. RNDr. Jozef Jirásek, PhD.

Date of last modification: 23.11.2021

Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ SDSD/15	**Course name:** Data and signal processing

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: present

Number of ECTS credits: 8

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
The ability to formulate a problem in the acquired terminology and solve it within a project.
Project.
Oral exam.

Learning outcomes:
During the completion of the course, the doctoral student will master the most relevant methods of signal processing and corresponding software. He will be able to explain the differences between the types of stochastic data models and thus analyze and simulate data, determine the scheme or dependence between attributes and obtain information.

Brief outline of the course:
1. Random processes and time series, Moving average, ARIMA processes.
2. Markov chains, Markov Chains Monte Carlo - MCMC.
3. Stationary processes and correlation function.
4. Martingales, Wiener process and SDE.
5. Fourier transformation, FFT, Fourier series.
6. Wavelet analysis.
7. Filtration, Kalman filter.
8. Modeling, Goodness of fit tests; Likelihood and Bayesian principle.
9. Mutual information, Fisher information, Akaike criterion.
10. Nonparametric estimation and approximation: Nadaraya-Watson kernel, Loess(locally estimated scatterplot smoothing).
11. Smoothing Spline and penalization, Multivariate adaptive regression spline (MARS), Generalized additive model (GAM).

Recommended literature:
R.P. Dobrow, Introduction to Stochastic Processes with R, Wiley, 2016, ISBN 978-1-118-74065-1
R.H. Shumway, D.S. Stoffer, Time Series Analysis and Its Applications, Examples with R, Springer, 2017, ISBN 978-3-319-52452-8
Ch. J. Geyer, Bayesian Inference via Markov Chain Monte Carlo (MCMC), 2021, https://www.stat.umn.edu/geyer/3701/notes/mcmc-bayes.html
G.P. Nason, Wavelet Methods in Statistics with R, Springer, 2011, ISBN: 978-0-387-75960-9

Ch. K. Chui, G. Chen, Kalman Filtering, Springer, ISBN 978-3-319-47610-0, 2017
Cs. Török, H.-P. Bernhard, Wavelet Shrinkage and Mutual Information, Communications of JINR, Dubna, Russia, 1999
Nonparametric Regression Smoothers in R, http://users.stat.umn.edu/~helwig/notes/smooth-notes.html#simple-smoothers-in-r
J. S. Simonoff, Smoothing Methods in Statistics, Springer, ISBN-13: 978-0387947167, 1996

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 10

N	P
0.0	100.0

Provides: doc. RNDr. Csaba Török, CSc.

Date of last modification: 23.11.2021

Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/ SIZD/15	**Course name:** Data processing and information profit

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: present

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:

Learning outcomes:
Overview of stochastic and numerical methods of processing data and signals, their modeling and obtaining information from them.

Brief outline of the course:
States, representation of dependencies and statistical models. Search schema and dependencies in data, classification of objects, parametric and nonparametric methods, smoothing data, piecewise approximation, splines, multivariate methods. Discriminant, cluster, factor, Fourier and wavelet analysis. Entropy and information function.

Recommended literature:
- E.Alpaydin: Introduction To Machine Learning, MIT Press, 2004
- S.Mallat, A Wavelet Tour of Signal Processing, Academic Press, 1999
- J.Anděl: Matematická statistika, SNTL 1985

Course language:

Notes:

Course assessment
Total number of assessed students: 1

N	P
0.0	100.0

Provides: doc. RNDr. Csaba Török, CSc.

Date of last modification: 03.05.2015

Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ ODZP/15	**Course name:** Defence of diploma thesis
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 30	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: The dissertation thesis is the result of the student's own scientific research. It must not show elements of academic fraud and must meet the criteria of good research practice defined in the Rector's Decision no. 21/2021, which lays down the rules for assessing plagiarism at Pavol Jozef Šafárik University in Košice and its components. Fulfillment of the criteria is verified mainly in the process of supervision and in the process of thesis defense. Failure to do so is reason for disciplinary action.	
Learning outcomes: The dissertation thesis has the character of a scientific work and the student demonstrates extensive mastery of the theory and professional terminology of the field of study, acquisition of knowledge, skills and competencies in accordance with the declared profile of the graduate of the study program, as well as the ability to apply them creatively in solving selected scientific problem. The student demonstrates the ability of independent scientific work in terms of content, formal and ethical. Further details on the dissetation thesis are determined by Directive no. 1/2011 on the basic requirements of final theses and the Study Regulations of UPJŠ in Košice for doctoral studies.	
Brief outline of the course: 1. Elaboration of the dissertation thesis in accordance with the instructions of the supervisor. 2, Presentation of the results of the dissertation thesis before the examination commission. 3. Answering questions from oponents and questions related to the topic of the dissertation thesis within the discussion.	
Recommended literature: The recommended literature is determined individually in accordance with the topic of the dissertation thesis.	
Course language: Slovak or English	
Notes:	

Course assessment Total number of assessed students: 16	
N	P
6.25	93.75
Provides:	
Date of last modification: 11.01.2022	
Approved: prof. RNDr. Stanislav Krajči, PhD.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ PPC/15	**Course name:** Direct pedagogical activities
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 3	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course: Teaching of two-hour exercise or seminar during the semester.	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 209	

abs	n
99.04	0.96

Provides:
Date of last modification: 11.11.2021
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ DZS/15	**Course name:** Dissertation examination
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 20	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 33	

N	P
0.0	100.0

Provides:
Date of last modification:
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: CJP/ AJD1/07	**Course name:** English Language for PhD Students 1

Course type, scope and the method:
Course type: Practice
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: present

Number of ECTS credits: 2

Recommended semester/trimester of the course: 1.

Course level: III.

Prerequisities:

Conditions for course completion:
Completion of e-course English for PhD Students (lms.upjs.sk), consultations (1-3).
Written assignments - Professional/Academic CV, Short Academic Biography.

Learning outcomes:
The development of students´ language skills - reading, writing, listening, speaking, improvement of their linguistic competence - students acquire knowledge of selected phonological, lexical and syntactic aspects, development of pragmatic competence - students can efectively use the language for a given purpose, with focus on Academic English and English for specific/professional purposes, level B2.

Brief outline of the course:
Specific aspects of academic and professional English with focus on correct pronunciation, vocabulary development (noun and verb collocations, phrasal verbs, prepositional phrases, word-formation, formal/informal language, etc.), selected aspects of English grammar (prepositions, grammar tenses, passive voice, etc.), academic writing (professional/academic CV, Short Academic Biography).

Recommended literature:
Moore, J.: Oxford Academic Vocabulary Practice. OUP, 2017.
Kolaříková, Z., Petruňová, H., Timková, R.: Angličtina v akademickom prostredí – cvičebnica. Košice, Vydavateľstvo ŠafárikPress, 2021.
Tomaščíková, S., Rozenfeld, J. Developing Academic English in Speaking and Writing. Vydavateľstvo ŠafárikPress, 2021.
McCarthy, M., O´Dell, F.: Academic Vocabulary in Use. CUP, 2008.
Štepánek, L., J. De Haff a kol.: Academic English-Akademická angličtina. Grada Publishing, a.s., 2011.
Armer, T.: Cambridge English for Scientists. CUP, 2011.
lms.upjs.sk

Course language:
English, level B2 according to CEFR

Notes:

Course assessment
Total number of assessed students: 738

N	Ne	P	Pr	abs	neabs
0.0	0.0	48.1	0.0	51.9	0.0

Provides: PhDr. Helena Petruňová, CSc., Mgr. Zuzana Kolaříková, PhD.

Date of last modification: 16.09.2022

Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: CJP/AJD2/07	**Course name:** English Language for PhD Students 2

Course type, scope and the method:
Course type: Practice
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: present

Number of ECTS credits: 3

Recommended semester/trimester of the course: 2.

Course level: III.

Prerequisities:

Conditions for course completion:
Test, oral exam in accordance with the exam requirements (https://www.upjs.sk/filozoficka-fakulta/cjp/doktorandi-upjs/)

Learning outcomes:
The development of students´ language skills - reading, writing, listening, speaking, improvement of their linguistic competence - students acquire knowledge of selected phonological, lexical and syntactic aspects, development of pragmatic competence - students can efectively use the language for a given purpose, with focus on Academic English and English for specific/professional purposes, level B2.

Brief outline of the course:
Academic communication (self-presentation, presenting at scientific meetings and conferences). Specific aspects of academic and professional English with focus on vocabulary development (formality, academic word-list), English grammar (passive voice, nominalisatio), language functions (expressing opinion, cause/effect, presenting arguments, giving examples, describing graphs/charts/schemes, etc.). Cross-language interference.

Recommended literature:
Moore, J.: Oxford Academic Vocabulary Practice. OUP, 2017.
Kolaříková, Z., Petruňová, H., Timková, R.: Angličtina v akademickom prostredí (cvičebnica). UPJŠ Košice, 2021.
Tomaščíková, S., Rozenfeld, J. Developing Academic English in Speaking and Writing. Vydavateľstvo ŠafárikPress, 2021.
McCarthy, M., O´Dell, F.: Academic Vocabulary in Use. CUP, 2008.
Štepánek, L., J. De Haff a kol.: Academic English-Akademická angličtina. Grada Publishing, a.s., 2011.
Armer, T.: Cambridge English for Scientists. CUP, 2011.

Course language:
B2 level according to CEFR

Notes:

Course assessment
Total number of assessed students: 729

N	Ne	P	Pr	abs	neabs
0.27	0.0	93.83	1.1	4.8	0.0

Provides: PhDr. Helena Petruňová, CSc., Mgr. Zuzana Kolaříková, PhD.

Date of last modification: 10.03.2022

Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/FKAD/15	**Course name:** Formal concept analysis

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: present

Number of ECTS credits: 8

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
During consultations during the semester.
Independent and creative mastery of theoretical and practical aspects of the issue and an overview of the current state of research and further direction, in the form of an oral exam, are evaluated.

Learning outcomes:
The aim of the course is to understand the basic features of formal conceptual analysis as one of the methods of relational-data analysis and its relationship to other data-mining methods.

Brief outline of the course:
Basic theorem on conceptual lattices.
Fuzzifications of concept lattices.
Formal conceptual analysis in terms of category theory.
Relationship of formal concept analysis to other data-mining methods.
Applications of formal concept analysis.

Recommended literature:
1. BĚLOHLÁVEK, Radim. Fuzzy relational systems: foundations and principles. New York: Kluwer Academic/Plenum Publishers, [2002]. International federation for systems research. ISBN 0-306-46777-1.
2. GANTER B, WILLE R.: Formal Concept Analysis: Foundations and Applications, Lecture Notes in Artificial Intelligence, no. 3626, Springer-Verlag, ISBN 3-540-27891-5, 2005

Course language:
Slovak or English

Notes:
Prerequisites: Logic

Course assessment
Total number of assessed students: 0

N	P
0.0	0.0

Provides: prof. RNDr. Stanislav Krajči, PhD.
Date of last modification: 23.11.2021
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/AFJD/15	**Course name:** Formal languages and finite-state automata

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: present

Number of ECTS credits: 9

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Written test combined with an oral examinationi.

Learning outcomes:
To obtain background about efficient representation of regular languages and finite state automata, as well as about connection between automata and complexity theory.

Brief outline of the course:
Chomsky hierachy of languages and grammars. Finite state automata and its variants: deterministic, nondeterministic, alternating, probabilistic, quantum ... one-way, two-way, reversal bounded. Regular expressions and grammars. Unary regular languages and their properties. Connection between finite state automata and complexity theory. Pushdown automata, time and space complexity for recognition of context-free languages. Closure properties of contex-free, context-sensitive, and recursively enumerable languages.

Recommended literature:
Current journal publications on the topic, especially those related to the descriptional complexity of automata.
J.E. Hopcroft, R.Motwani, J.D. Ullman: Introduction to automata theory, languages, and computation, Addison-Wesley, 2001.
J. Shallit: A second course in formal languages and automata theory, Cambridge University press, 2009.
M. Sipser: Introduction to the theory of computation, Thomson Course Technology, 2006.
D.P.Bovet, P.Crescenzi: Introduction to the theory of complexity, Prentice Hall, 1994.
J.van Leeuwen (ed.): Handbook of theoretical science, North-Holland, 1990.
G.Brassard, P.Bradley: Fundamentals of algorithmics, Prentice Hall, 1996.

Course language:
Slovak or English

Notes:
Content prerequisites: Basic knowledge in the area of automata, formal languages, set theory, and graph theory.

Course assessment Total number of assessed students: 14	
N	P
0.0	100.0
Provides: prof. RNDr. Viliam Geffert, DrSc.	
Date of last modification: 23.11.2021	
Approved: prof. RNDr. Stanislav Krajči, PhD.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ NEM/15	**Course name:** Installing of new experimental methods
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 15	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 5	

abs	n
100.0	0.0

Provides:
Date of last modification: 03.05.2015
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ MK/15	**Course name:** International conference
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 6	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 81	

abs	n
97.53	2.47

Provides:	
Date of last modification: 03.05.2015	
Approved: prof. RNDr. Stanislav Krajči, PhD.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ ZKC/15	**Course name:** International currented journal
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 20	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 21

abs	n
100.0	0.0

Provides:
Date of last modification: 03.05.2015
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ ZNC/15	**Course name:** International non-currented journal
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 8	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 13

abs	n
100.0	0.0

Provides:
Date of last modification: 03.05.2015
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ NZ/15	**Course name:** International or local not-reviewed proceedings
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 4	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 20

abs	n
100.0	0.0

Provides:
Date of last modification: 03.05.2015
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/DK/15	**Course name:** Local conference

Course type, scope and the method:
Course type:
Recommended course-load (hours):
Per week: Per study period:
Course method: present

Number of ECTS credits: 2

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Active participation in the home conference

Learning outcomes:
By actively participating in the national scientific conference, the PhD student demonstrates a high degree of ability to identify, evaluate, and apply correct scientific methods or research methodology in his scientific field. He demonstrates the ability to reflect on a specific scientific problem by using the latest approaches and applying them critically. Demonstrates competence in using existing theories and concepts in an innovative way, as well as generating new original scientific knowledge and communicating research results to a wider audience using adequate means and through the Slovak language.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 30

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ DKZU/15	**Course name:** Local conference with international participation
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 4	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment

Total number of assessed students: 47

abs	n
100.0	0.0

Provides:
Date of last modification: 03.05.2015
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ DKC/15	**Course name:** Local currented journal
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 15	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 1	

abs	n
100.0	0.0

Provides:
Date of last modification: 03.05.2015
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ DNC/15	**Course name:** Local non-currented journal
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 5	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 4

abs	n
100.0	0.0

Provides:
Date of last modification: 03.05.2015
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/LOGD/15	**Course name:** Logic

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: present

Number of ECTS credits: 9

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Satisfiable understanding of basic concepts.

Learning outcomes:
Understanding of basic notions of mathematical logic (logic language, term, formula, axioms, proof, provability, truth, model, syntax and semantics, soundness, completeness) and ability to formalize concisely.

Brief outline of the course:
Predicate logic – logic language, syntax and semantics, term, formula.
Axioms, proof, provability.
Interpretation, truth, model.
Correctness of the predicate logic.
Boolean algebras.
Syntactic model, completeness of predicate logic.
Inductive structures in general.
Aplications of logic in database systems.

Recommended literature:
1. GOLDSTERN, M., JUDAH H.: The Incompleteness Phenomenon, A New Course in Mathematical Logic, A K Peters, Wellesley, Massachusetts, 1995
2. ABITEBOUL, S. HULL, R., VIANU, V.: Foundations of databases, Addison-Wesley Publishing Co, 1995

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 11

N	P
0.0	100.0

Provides: prof. RNDr. Stanislav Krajči, PhD.
Date of last modification: 23.11.2021
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ POVK/15	**Course name:** Membership in a conference organizing committee
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 2	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 24

abs	n
100.0	0.0

Provides:
Date of last modification: 03.05.2015
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/MBPD/15	**Course name:** Modelling and analysis of security protocols

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: present

Number of ECTS credits: 9

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Written and oral exam.

Learning outcomes:
To learn essential properties of the used cryptographic authentication and certification schemes and standard methods of attacks to them. To understand the theoretical background of a design of formal models and know how it is possible to utilise them in practise. To know the actual problems concerning the analysis of the security of cryptographic protocols.

Brief outline of the course:
Authentication and certification schemes, key distribution and maintenance. Formal description of cryptographic protocols and methods for their analysis. Algebraic and logic methods for attack modelling, utilisation of dynamic logical systems. Datalog for automatic security verification.

Recommended literature:
1. RYAN, P. Y. A., SCHNEIDER, S.A.: Modelling and Analysis of Security Protocols, Addison Wesley, 2001
2. HUTH, M., RYAN, M.: Logic in Computer Science - Modelling and Reasoning about Systems, CUP, 1999
3. MENEZES, A., van OORSCHOT, P., VANSTONE, S.: Handbook of Applied Cryptography, CRC Press, 1996

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 4

N	P
0.0	100.0

Provides: prof. RNDr. Gabriel Semanišin, PhD., doc. RNDr. Jozef Jirásek, PhD.

Date of last modification: 23.11.2021

Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ MNID/15	**Course name:** Models of imperfect information
Course type, scope and the method: **Course type:** Lecture **Recommended course-load (hours):** **Per week:** 2 **Per study period:** 28 **Course method:** present	
Number of ECTS credits: 9	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: During consultations during the semester. Independent and creative mastery of theoretical and practical aspects of the issue, an overview of the current state of research and open problems and further direction, in the form of a written and oral exam, are evaluated.	
Learning outcomes: To give the students basic techniques in systems processing imperfect information to be able read and write scientific papers in the area.	
Brief outline of the course: Belief and probability, Dempster-Shaferova belief. Necessity and possibility. Uncertainty in artificial intelligence. Fuzzy sets, constructions of fuzzy sets from statistic data. Uncertainty in artificial intelligence, Markov and Bayesian networks, belief updating, belief revision.	
Recommended literature: 1. PEARL J.: Probabilistic Reasoning in Intelligent Systems: Networks of Plausible Inference, Morgan – Kaufmann, San Francisco, CA, 1988 2. JENSEN, F. V.: An Introduction to Bayesian networks, UCL Press, 1996 3. DUBOIS, D., Prade, H.: Possibility Theory. Plenum Press, N.York, 1988 4. PARIS, J. B.: The uncertain Reasoners Companion. Cambridge University Press, 1994	
Course language: Slovak or English	
Notes: prerequisites: Logic	

Course assessment Total number of assessed students: 2	
N	P
0.0	100.0
Provides: prof. RNDr. Stanislav Krajči, PhD.	
Date of last modification: 23.11.2021	
Approved: prof. RNDr. Stanislav Krajči, PhD.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ NEK1/15	**Course name:** Neurocognition

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: 2 / 2 **Per study period:** 28 / 28
Course method: present

Number of ECTS credits: 9

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Midterm exam. Project
Final exam consisting of written and/or oral part.

Learning outcomes:
Skills in quantitative analysis and modeling of neural data. Overview of cognitive functions and their neural basis in the human brain.

Brief outline of the course:
1. Cognitive Science
2. Neuron, synaptic transmission, CNS, experimental methods
3. Hearing and speech: general intro
4. Spatial hearing
5. Auditory scene analysis, "Cocktail party effect", informational masking.
6. Vision: Intro - pathways, perception, illusions.
7. Binocular and spatial vision.
8. Visual motion perception.
9. Sensory and motor system.
10. Memory.
11. Attention.
12. Emotions, motivation,conditioning and reinforcement learning

Recommended literature:
1. Poeppel D., Mangun G., Gazzaniga M. (ed.): The Cognitive Neurosciences. 6th ed. MIT Press. 2020. ISBN-13: 978-0262043250
2. Dayan P and LF Abbott: Theoretical Neuroscience - Computational and Mathematical Modeling of Neural Systems. MIT Press, 2005 ISBN-13: 978-0262541855
3. Thagard P: Mind: Introduction to Cognitive Science, 2nd Edition. Bradford Books. ISBN-13 : 978-0262701099
4. KANDEL, E. R., SCHWARTZ, J. H. and JESSELL, T.M.: Principles of Neural Science. McGraw-Hill, 2021 ISBN-13: 978-1259642234
5. HERTZ, J., KROGH, A. and PALMER R. G.: Introduction to the theory of neural computation. Addison-Wesley 1991 ISBN-13: 978-0201515602

Course language:
English

Notes:
Content prerequisities: programming, mathematics, basics of neurobiology and cognitive psychology

Course assessment
Total number of assessed students: 4

N	P
0.0	100.0

Provides: doc. Ing. Norbert Kopčo, PhD.

Date of last modification: 23.11.2021

Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ IG/15	**Course name:** Obtaining of internal grant
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 10	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 39

abs	n
100.0	0.0

Provides:
Date of last modification: 03.05.2015
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ PVS/15	**Course name:** Patents, inventions, and software
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 2	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Patent filed, invention, software product created.	
Learning outcomes: The PhD student demonstrates the ability to create an innovative product in a given scientific field, or with impact on an interdisciplinary scale or in technical practice	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 11	

abs	n
100.0	0.0

Provides:	
Date of last modification: 08.11.2022	
Approved: prof. RNDr. Stanislav Krajči, PhD.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ VYS/15	**Course name:** Presentation of results in a seminar
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 2	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 89	

abs	n
100.0	0.0

Provides:
Date of last modification: 03.05.2015
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/PAHD/15	**Course name:** Probabilistic and approximate algorithms

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: 2 / 1 **Per study period:** 28 / 14
Course method: present

Number of ECTS credits: 9

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Written test combined with an oral examination.

Learning outcomes:
Providing en extended backgroung in the area of probabilistic and approximation algorithms, with respect to their classification, efficiency, and probability of error.

Brief outline of the course:
1. Elementary probability theory. Basic probabilistic computational models.
2. Las Vegas algorithms, One-sided error Monte Carlo algorithms.
3. Two-sided error Monte Carlo algorithms, with bounded and unbounded-error.
4. Probabilistic classes with polynomial time.
5. Foiling the adversary
6. Hashing.
7. Fingerprinting.

Recommended literature:
1. HROMKOVIČ, J.: Design and analysis of ranodmized algorithms. Springer-Verlag, 2005. ISBN 3-540-23949-9.
2. MOTWANI, R. and RAGHAVAN, P.: Randomized Algorithms. Cambridge University Press 1995. ISBN 0-521-47465-5
3. MITZEMANCHER, M. and UPFAL, E.: Probability and Computing: Randomized Algorithms and Probabilistic Analysis. Cambridge University Press 2005. ISBN 0-521-83540 2
4. HROMKOVIČ, J.: Communication Protocols - An Exemplary Study of the Power of Randomness. In: Handbook on Randomized Computing, P.Pardalos, S.Rajasekaran, J.Reif, J.Rolim, Eds., Kluwer Publ., 2001.

Course language:
Slovak or English

Notes:
Content prerequisities: Basic knowlegde of in the area of probability theory, computational complexity, and programming.

Course assessment Total number of assessed students: 10	
N	P
0.0	100.0
Provides: prof. RNDr. Viliam Geffert, DrSc., prof. RNDr. Gabriel Semanišin, PhD.	
Date of last modification: 23.11.2021	
Approved: prof. RNDr. Stanislav Krajči, PhD.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/KVAD/15	**Course name:** Quantum algorithms

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: present

Number of ECTS credits: 8

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
oral exam

Learning outcomes:
To learn how quantum algorithms can be used for solving hard problems, in coding theory and in cryptology.

Brief outline of the course:
Quantum information. Principles and power of quantum computing. Fast factorisation. Qunatum search algorithm anf ther application for NP-hard problems. The class BQNP - an analogy of the class NP. Quantum coding. Quantum kryptography.

Recommended literature:
1. GRUSKA, J. Quantum Computing. McGraw-Hill, 1999.
2. HIRVENSALO, M. Quantum Computing, Springer, 2004.
3. KITAEV, A.Y., SHEN, A.H., VYVALYI, M.N. Classical and Quantum Computation. American Mathematical Society, 2002.
4. NIELSEN, M.A., CHUANG, I.L. Quantum Computation and Quantum Information. Cambridge University Press, 2000.
5. STEEB, W. H., HARDY, Y. Problems And Solutions in Quantum Computing And Quantum Information. World Scientific Publishing Company, 2006.

Course language:
Slovak or English

Notes:
Content prerequisities: Linear algebra. Hillbert space. Introduction to quantum mechanics. Computational complexity.

Course assessment
Total number of assessed students: 0

N	P
0.0	0.0

Provides: prof. RNDr. Gabriel Semanišin, PhD.
Date of last modification: 23.11.2021
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ VPBP/15	**Course name:** Review of a bachelor thesis
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 2	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 51	

abs	n
100.0	0.0

Provides:
Date of last modification: 03.05.2015
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ RZ/15	**Course name:** Rewieved international or local proceedings
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 10	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 111	

abs	n
100.0	0.0

Provides:
Date of last modification: 03.05.2015
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ SCI/15	**Course name:** SCI citation
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 20	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 7	

abs	n
100.0	0.0

Provides:
Date of last modification: 03.05.2015
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/ VKDD/15	**Course name:** Selected topics on numerical analysis and data mining

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: present

Number of ECTS credits: 8

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
The ability to formulate a problem in the acquired terminology and solve it within a project.
Project.
Oral exam.

Learning outcomes:
Upon completion of the course, the doctoral student, when solving a new type of problem, is able to choose a suitable method based on the analysis of requirements and principles of the considered numerical method and algorithm. The student will master suitable software for data processing and information gain.

Brief outline of the course:
1. Solving Systems of Equations, QR, SVD and eigenfaces
2. Orthogonalization
3. Splines of class C2, B-splines, Uniform and non-uniform splines
4. Interpolation splines; 2D and 3D splines
5. Parametric Data approximation and smoothing
6. Piecewise approximation with automatic node detection and penalization
7. Chebyshev nodes and CHEBFUN
8. Logistic regression
9. Multidimensional methods, Principal components
10. Factor analysis, Discriminant analysis
11. Cluster analysis

Recommended literature:
E. Süli, D.F. Mayers, An Introduction to Numerical Analysis, Cambridge University Press, 2003, ISBN 0 521 81026 4
V.A. Bloomfield, Using R for Numerical Analysis in Science and Engineering, Chapman & Hall, 2014, 978-1-4398-8449-2
S. Sheather, A Modern Approach to Regression with R, Springer, 2009, 978-0-387-09607-0
R.I. Kabacoff, R in Action, Data analysis and graphics with R, 3rd edition, Manning, 2021, ISBN-13: 978-1617296055
J. Andel, Matematická statistika, SNTL/ALFA, 1985

T. Hastie, R. Tibshurani, J.H. Friedman, The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Spinger, 2017, 978-0387848570
O. Jones, R. Maillardet, A. Robinson, Introduction to Scientific Programming and Simulation Using R, Chapman & Hall, 2nd Edition, 2014, 978-1-4665-7001-6

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 1

N	P
0.0	100.0

Provides: doc. RNDr. Csaba Török, CSc.

Date of last modification: 23.11.2021

Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/ SOS1a/15	**Course name:** Special branch seminar

Course type, scope and the method:
Course type: Practice
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: present

Number of ECTS credits: 5

Recommended semester/trimester of the course: 1.

Course level: III.

Prerequisities:

Conditions for course completion:
The condition for passing the course is a summary presentation of the student's results in the field of research and a presentation of studied professional and scientific texts.

Learning outcomes:
The result of the education is the student's guidance to independent and creative extraction of the latest knowledge focused on issues related to the topic of the student's dissertation and continuous verification of his ability to present the newly acquired knowledge.

Brief outline of the course:
1. Independent study of professional and scientific texts focused on issues related to the topic of the dissertation,
2. Presentation of newly acquired knowledge,
3. Summary presentation of research activities.

Recommended literature:
Current professional and scientific literature in the field of dissertation topic or related field.

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 43

abs	n
100.0	0.0

Provides: prof. RNDr. Viliam Geffert, DrSc., doc. RNDr. JUDr. Pavol Sokol, PhD.

Date of last modification: 21.11.2021

Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/ SOS1b/15	**Course name:** Special branch seminar

Course type, scope and the method:
Course type: Practice
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: present

Number of ECTS credits: 5

Recommended semester/trimester of the course: 2.

Course level: III.

Prerequisities:

Conditions for course completion:
The condition for passing the course is a summary presentation of the student's results in the field of research and a presentation of studied professional and scientific texts.

Learning outcomes:
The result of the education is the student's guidance to independent and creative extraction of the latest knowledge focused on issues related to the topic of the student's dissertation and continuous verification of his ability to present the newly acquired knowledge.

Brief outline of the course:
1. Independent study of professional and scientific texts focused on issues related to the topic of the dissertation,
2. Presentation of newly acquired knowledge,
3. Summary presentation of research activities.

Recommended literature:
Current professional and scientific literature in the field of dissertation topic or related field.

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 42

abs	n
100.0	0.0

Provides: prof. RNDr. Viliam Geffert, DrSc., doc. RNDr. JUDr. Pavol Sokol, PhD.

Date of last modification: 21.11.2021

Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/ SOS2a/15	**Course name:** Special branch seminar

Course type, scope and the method:
Course type: Practice
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: present

Number of ECTS credits: 5

Recommended semester/trimester of the course: 3.

Course level: III.

Prerequisities:

Conditions for course completion:
The condition for passing the course is a summary presentation of the student's results in the field of research and a presentation of studied professional and scientific texts.

Learning outcomes:
The result of the education is the student's guidance to independent and creative extraction of the latest knowledge focused on issues related to the topic of the student's dissertation and continuous verification of his ability to present the newly acquired knowledge.

Brief outline of the course:
1. Independent study of professional and scientific texts focused on issues related to the topic of the dissertation,
2. Presentation of newly acquired knowledge,
3. Summary presentation of research activities.

Recommended literature:
Current professional and scientific literature in the field of dissertation topic or related field.

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 40

abs	n
100.0	0.0

Provides: prof. RNDr. Viliam Geffert, DrSc., doc. RNDr. JUDr. Pavol Sokol, PhD.

Date of last modification: 21.11.2021

Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/ SOS2b/15	**Course name:** Special branch seminar

Course type, scope and the method:
Course type: Practice
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: present

Number of ECTS credits: 5

Recommended semester/trimester of the course: 4.

Course level: III.

Prerequisities:

Conditions for course completion:
The condition for passing the course is a summary presentation of the student's results in the field of research and a presentation of studied professional and scientific texts.

Learning outcomes:
The result of the education is the student's guidance to independent and creative extraction of the latest knowledge focused on issues related to the topic of the student's dissertation and continuous verification of his ability to present the newly acquired knowledge.

Brief outline of the course:
1. Independent study of professional and scientific texts focused on issues related to the topic of the dissertation,
2. Presentation of newly acquired knowledge,
3. Summary presentation of research activities.

Recommended literature:
Current professional and scientific literature in the field of dissertation topic or related field.

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 36

abs	n
100.0	0.0

Provides: prof. RNDr. Viliam Geffert, DrSc., doc. RNDr. JUDr. Pavol Sokol, PhD.

Date of last modification: 21.11.2021

Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/ SOS3a/15	**Course name:** Special branch seminar

Course type, scope and the method:
Course type: Practice
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: present

Number of ECTS credits: 5

Recommended semester/trimester of the course: 5.

Course level: III.

Prerequisities:

Conditions for course completion:
The condition for passing the course is a summary presentation of the student's results in the field of research and a presentation of studied professional and scientific texts.

Learning outcomes:
The result of the education is the student's guidance to independent and creative extraction of the latest knowledge focused on issues related to the topic of the student's dissertation and continuous verification of his ability to present the newly acquired knowledge.

Brief outline of the course:
1. Independent study of professional and scientific texts focused on issues related to the topic of the dissertation,
2. Presentation of newly acquired knowledge,
3. Summary presentation of research activities.

Recommended literature:
Current professional and scientific literature in the field of dissertation topic or related field.

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 38

abs	n
100.0	0.0

Provides: prof. RNDr. Viliam Geffert, DrSc., doc. RNDr. JUDr. Pavol Sokol, PhD.

Date of last modification: 21.11.2021

Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/ SOS3b/15	**Course name:** Special branch seminar

Course type, scope and the method:
Course type: Practice
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: present

Number of ECTS credits: 5

Recommended semester/trimester of the course: 6.

Course level: III.

Prerequisities:

Conditions for course completion:
The condition for passing the course is a summary presentation of the student's results in the field of research and a presentation of studied professional and scientific texts.

Learning outcomes:
The result of the education is the student's guidance to independent and creative extraction of the latest knowledge focused on issues related to the topic of the student's dissertation and continuous verification of his ability to present the newly acquired knowledge.

Brief outline of the course:
1. Independent study of professional and scientific texts focused on issues related to the topic of the dissertation,
2. Presentation of newly acquired knowledge,
3. Summary presentation of research activities.

Recommended literature:
Current professional and scientific literature in the field of dissertation topic or related field.

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 35

abs	n
100.0	0.0

Provides: prof. RNDr. Viliam Geffert, DrSc., doc. RNDr. JUDr. Pavol Sokol, PhD.

Date of last modification: 21.11.2021

Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/ SOS4a/15	**Course name:** Special branch seminar

Course type, scope and the method:
Course type: Practice
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: present

Number of ECTS credits: 5

Recommended semester/trimester of the course: 7.

Course level: III.

Prerequisities:

Conditions for course completion:
The condition for passing the course is a summary presentation of the student's results in the field of research and a presentation of studied professional and scientific texts.

Learning outcomes:
The result of the education is the student's guidance to independent and creative extraction of the latest knowledge focused on issues related to the topic of the student's dissertation and continuous verification of his ability to present the newly acquired knowledge.

Brief outline of the course:
1. Independent study of professional and scientific texts focused on issues related to the topic of the dissertation,
2. Presentation of newly acquired knowledge,
3. Summary presentation of research activities.

Recommended literature:
Current professional and scientific literature in the field of dissertation topic or related field.

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 24

abs	n
100.0	0.0

Provides: prof. RNDr. Viliam Geffert, DrSc., doc. RNDr. JUDr. Pavol Sokol, PhD.

Date of last modification: 21.11.2021

Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/ SOS4b/15	**Course name:** Special branch seminar

Course type, scope and the method:
Course type: Practice
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: present

Number of ECTS credits: 5

Recommended semester/trimester of the course: 8.

Course level: III.

Prerequisities:

Conditions for course completion:
The condition for passing the course is a summary presentation of the student's results in the field of research and a presentation of studied professional and scientific texts.

Learning outcomes:
The result of the education is the student's guidance to independent and creative extraction of the latest knowledge focused on issues related to the topic of the student's dissertation and continuous verification of his ability to present the newly acquired knowledge.

Brief outline of the course:
1. Independent study of professional and scientific texts focused on issues related to the topic of the dissertation,
2. Presentation of newly acquired knowledge,
3. Summary presentation of research activities.

Recommended literature:
Current professional and scientific literature in the field of dissertation topic or related field.

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 24

abs	n
100.0	0.0

Provides: prof. RNDr. Viliam Geffert, DrSc., doc. RNDr. JUDr. Pavol Sokol, PhD.

Date of last modification: 21.11.2021

Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: Dek. PF UPJŠ/JSD/14	**Course name:** Spring School for PhD Students

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: Per study period: 4d
Course method: present

Number of ECTS credits: 2

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Active participation in the Spring School of PhD students of UPJŠ.

Learning outcomes:
By actively participating in the Spring School of PhD Students of UPJŠ, the PhD student demonstrates a high level of ability to process the issues of his dissertation for a multidisciplinary audience with an emphasis on clarifying the motivation, scientific problem, processing methodology and own contribution to the solution of the selected topic. The PhD student demonstrates the ability to professionally discuss various research topics, present his own positions and accept a plurality of opinions. Demonstrates the ability to communicate research results to a wider professional audience with adequate means and through the Slovak language.

Brief outline of the course:
1. Interdisciplinary lectures from the fields of medicine, natural sciences, law, public affairs, humanities. Lecturers - top foreign or national experts from the mentioned fields.
2. Scientific lectures in sections created within related disciplines. Lecturers - top experts from UPJŠ from the mentioned fields.
3. Scientific contributions of PhD students in sections of related fields.
4. Panel discussions on the issue of PhD studies and current trends in the development of scientific disciplines at UPJŠ.

Recommended literature:
Proceedings of the Spring School of Doctoral Students.

Course language:

Notes:

Course assessment
Total number of assessed students: 187

abs	n
100.0	0.0

Provides: doc. RNDr. Marián Kireš, PhD.

Date of last modification: 08.11.2022
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ ZSP/15	**Course name:** Studies at foreign universities
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 2	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 23

abs	n
100.0	0.0

Provides:
Date of last modification: 03.05.2015
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ VPSV/15	**Course name:** Supervision of a students scientific work
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 6	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 21	

abs	n
100.0	0.0

Provides:
Date of last modification: 03.05.2015
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ VBP/15	**Course name:** Supervision of bachelor thesis
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 6	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course: Guiding the bachelor's student during the elaboration of the bachelor's thesis, which the student submits for defense.	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 54	

abs	n
100.0	0.0

Provides:
Date of last modification: 11.11.2021
Approved: prof. RNDr. Stanislav Krajči, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ PDS/18	**Course name:** The thesis for dissertation exam
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 0	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: The thesis for dissertation exam is the result of the student's own scientific research. It must not show elements of academic fraud and must meet the criteria of good research practice defined in the Rector's Decision no. 21/2021, which lays down the rules for assessing plagiarism at Pavol Jozef Šafárik University in Košice and its components. Fulfillment of the criteria is verified mainly in the process of supervision and in the process of thesis defense. Failure to do so is reason for disciplinary action.	
Learning outcomes: The thesis for dissertation exam has the character of a scientific work and the student demonstrates extensive mastery of the theory and professional terminology of the field of study, acquisition of knowledge, skills and competencies in accordance with the declared profile of the graduate of the study program, elaboration of the state of the art in the given area and formulation of original scientific goals. The student demonstrates the ability of independent scientific work in terms of content, formal and ethical. Further details on the thesis for dissertation exam are determined by Directive no. 1/2011 on the basic requirements of final theses and the Study Regulations of UPJŠ in Košice for doctoral studies.	
Brief outline of the course: 1. Elaboration of the dissertation thesis in accordance with the instructions of the supervisor. 2, Presentation of the results of the dissertation thesis before the examination commission. 3. Answering oponents' questions and questions related to the topic of the dissertation thesis within the discussion.	
Recommended literature: The recommended literature is determined individually in accordance with the topic of the dissertation thesis.	
Course language: Slovak or English	
Notes:	

Course assessment Total number of assessed students: 2	
N	P
0.0	100.0
Provides:	
Date of last modification: 19.11.2021	
Approved: prof. RNDr. Stanislav Krajči, PhD.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/TNSD/15	**Course name:** Theoretical aspects of neural networks

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 2 **Per study period:** 28
Course method: present

Number of ECTS credits: 9

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Evaluation of individual work in the study of theoretical issues of neural networks - advanced methods of neural networks. Oral examination based on selected type of neural network.

Learning outcomes:
To understand mathematical principles of neural networks and to know their capabilities. To be able to construct models of neural networks to solve some problems.

Brief outline of the course:
1.-3. Computational complexity of neural networks.
4.-6. Probabilistic neural networks.
7.-9. Computational capability of neural networks, a transformation of neural networks to Turing machines, and Turing machines to neural networks.
10.-12. Approximation of functions using neural networks.
13. Kolmogorov theorem and its proof, theorems connected to Kolmogorov theorem.

Recommended literature:
1. GOODFELLOW Ian, BENGIO Yoshua a Aaron COURVILLE. Deep Learning. MIT Press, 2016. ISBN: 9780262035613.
2. HERTZ, John, Anders KROGH a Richard G. PALMER. Introduction to the theory of neural computation. Redwood City: CRC Press, [1991]. Santa Fe Institute studies in the sciences of complexity. ISBN 0-201-51560-1.
3. KVASNIČKA, Vladimír. Úvod do teórie neurónových sietí. [Slovenská republika]: IRIS, 1997. ISBN 80-88778-30-1.
4. ŠÍMA, Jiří a Roman NERUDA. Teoretické otázky neuronových sítí. Praha: MATFYZPRESS, 1996. ISBN 80-85863-18-9.
5. HASSOUN, M. H.: Fundamentals of artificial neural networks, The MIT Press, 1995.
6. HAYKIN, S.: Neural Networks, A comprehensive foundation, Prentice-Hall, second edition 1999.

Course language:
Slovak or English

Notes:

Course assessment Total number of assessed students: 27	
N	P
0.0	100.0
Provides: doc. RNDr. Gabriela Andrejková, CSc., doc. RNDr. Ľubomír Antoni, PhD.	
Date of last modification: 20.09.2021	
Approved: prof. RNDr. Stanislav Krajči, PhD.	