CONTENT

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: CJP/ PFAJAKA/07	**Course name:** Academic English

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:

Course level: I.

Prerequisities:

Conditions for course completion:
Active classroom participation, assignments handed in on time, 2 absences tolerated
1 test (13th week), no retake.
Presentation on chosen topic
Final evaluation- average assessment of test (50%), and presentation (50%).
Grading scale: A 93-100%, B 86-92%, C 79-85%, D 72-78%, E 65-71%, FX 64% and less

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, level B2.

Brief outline of the course:
Formal and informal English
Academic English and its specific features
Key academic verbs and nouns
Linking words in academic writing, writing a paragraph, word-order, topic sentences
Word-formation - affixation
abstract
Selected aspects of English pronunciation, academic vocabulary
Selected functional grammar structures - defining, classifying, epressing opinion, cause-effect, paraphrasing

Recommended literature:
Seal B.: Academic Encounters, CUP, 2002
T. Armer :Cambridge English for Scientists, CUP 2011
M. McCarthy M., O´Dell F. - Academic Vocabulary in Use, CUP 2008
Zemach, D.E, Rumisek, L.A: Academic Writing, Macmillan 2005
Olsen, A. : Active Vocabulary, Pearson, 2013
www.bbclearningenglish.com
Cambridge Academic Content Dictionary, CUP, 2009

Course language:
English language, level B2 according to CEFR.

Notes:

Course assessment
Total number of assessed students: 435

A	B	C	D	E	FX
36.09	22.3	14.94	9.89	5.75	11.03

Provides: Mgr. Viktória Mária Slovenská

Date of last modification: 11.09.2024

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ PPPy/24	**Course name:** Advanced programming in Python

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

Number of ECTS credits: 2

Recommended semester/trimester of the course: 4.

Course level: I., N

Prerequisities: ÚINF/PAZ1a/15

Conditions for course completion:
At least 50 % of the marks in the continuous assessment
A minimum of 50 % marks in the mid-term and end-of-semester practical tests
or
The final project - 100%

Learning outcomes:
Implement solutions to selected problems in Python using available modules. Use and implement non-trivial algorithms to solve selected problems. Use an object-oriented approach to problem solving. Program in Python in an object-oriented manner using Python specifics. Test programs. Implement parallel computing.

Brief outline of the course:
1. Introduction to the environment, basic features of Python, simple and structured data types.
2. Input, output, function definition, lambda function, generator notation, function as parameter, string formatting.
3. Control structures, iterating over data structures, context manager.
4. Exception handling and exception raising. Philosophy of exceptions in Python.
5. Working with files. Serialization and deserialization of data - json and pickle protocol. Text and binary files. Manipulation with files. Open data.
6. Object-oriented programming 1. Design of custom classes, special methods, properties, philosophy of accessing methods and attributes.
7. Object-oriented programming 2. Comparison and differences with Java. Multiple inheritance.
8. Method overloading. Static methods, abstract classes, data class.
9. Decorators, memoization, modules, packages.
10. Code validation (debugging), testing (doctest, unittest), test-driven development.
11. Parallel computing, processes, process triggering and inter-process communication (shared variable, pipe, queue).
12. Graphical program design and implementation.

Recommended literature:
PILGRIM, Mark. Dive into Python 3. 2. United States of America: Apress, 2004. ISBN 978-1430224150. Dostupné také z: https://diveintopython3.net/

SHIPMAN, John W. Tkinter 8.5 reference: a GUI for Python. Socorro, NM 87801: New Mexico Tech Computer Center, 2013. Dostupné také z: https://anzeljg.github.io/rin2/book2/2405/docs/tkinter/tkinter.pdf
LOTT, Steven F. Mastering Object-oriented Python. Birmingham B3 2PB, UK: Packt Publishing, 2014. ISBN 978-1-78328-097-1.

Course language:
Slovak language, knowledge of English language is only required to read documentation of Python.

Notes:

Course assessment
Total number of assessed students: 86

A	B	C	D	E	FX
6.98	13.95	26.74	17.44	20.93	13.95

Provides: PaedDr. Ján Guniš, PhD., univerzitný docent, RNDr. Zoltán Szoplák, doc. RNDr. Ľubomír Šnajder, PhD.

Date of last modification: 08.04.2024

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ALGa/10	**Course name:** Algebra I

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: 3 / 3 **Per study period:** 42 / 42
Course method: present

Number of ECTS credits: 7

Recommended semester/trimester of the course: 1.

Course level: I.

Prerequisities:

Conditions for course completion:
According to the results from the semester and in view of the results of the written and oral final exam..

Learning outcomes:
To acquire the methods of mathematical thinking and cognition. Gain basic knowledge of number theory related to divisibility, master the basic concepts of linear algebra and be able to apply them to specific problems and mathematical problems.

Brief outline of the course:
Divisibility in Z. Fields. Systems of linear equations, Gauss elimination. Maps, permutations. Computing with matrices. Determinants, Cramer rule.

Recommended literature:
T. Katriňák a kol.: Algebra a teoretická aritmetika 1, Alfa Bratislava, 1985.
T.S Blyth, E.F. Robertson: Basic linear algebra, Springer Verlag, 2001.
K. Jänich: Linear algebra, Springer Verlag, 1991.

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 1563

A	B	C	D	E	FX
11.64	11.52	18.11	17.85	28.6	12.28

Provides: RNDr. Lucia Kőszegyová, PhD., Mgr. Martin Vodička, Dr. rer. nat., Mgr. Radka Schwartzová

Date of last modification: 16.04.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ALG3b/22 | **Course name:** Algebra II for informaticians

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: 4 / 2 **Per study period:** 56 / 28
Course method: present

Number of ECTS credits: 7

Recommended semester/trimester of the course: 2.

Course level: I.

Prerequisities: ÚMV/ALGa/10

Conditions for course completion:
Exam

Learning outcomes:
To provide deeper knowledge on vector spaces, linear transformations and Euclidean spaces.

Brief outline of the course:
Vector spaces, subspaces. A basis, a dimension and a characterization of n-dimensional vector spaces. The rank of a matrix. Linear transformations and their matrices. Operations with linear tranformations, matrices of sums and compositions of linear tranformations. Regular linear transformations, regular matrices. Similar matrices. Characteristic vectors and characteristic values of linear transformations.
Affine spaces, subspaces and their positions. Euclidean spaces, the distance of subspaces. Conics and quadrics.

Recommended literature:
G. Birkhoff, S. Mac Lane: A Survey of Modern Algebra, New York 1965
T. Katriňák a kol.: Algebra a teoretická aritmetika 1, Alfa Bratislava, 1985
M. Sekanina, L. Boček, M. Kočandrle, J.Šedivý: Geometrie 1, SPN Praha 1986
M. Hejný, V. Zaťko, P. Kršňák: Geometria 1, SPN Bratislava 1985
J. Eliaš, J. Horváth, J. Kajan: Zbierka úloh z vyššej matematiky 1, Alfa Bratislava
A. F. Beardon: Algebra and Geometry, Cambridge University Press, 2005

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 361

A	B	C	D	E	FX
15.24	9.7	14.13	19.67	31.86	9.42

Provides: doc. RNDr. Roman Soták, PhD., Mgr. Martin Vodička, Dr. rer. nat.

Date of last modification: 16.04.2022
Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ ASU1/15	**Course name:** Algorithms and data structures

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: 4

Recommended semester/trimester of the course: 4., 6.

Course level: I., N

Prerequisities: ÚINF/PAZ1a/15 and ÚINF/PAZ1b/15

Conditions for course completion:
Practice activities, homeworks and midterm exam.
Final examination consisting of practice and theoretical test.

Learning outcomes:
Understand and learn algorithmic paradigms and data structures. Analyse time complexity of these algorithms.

Brief outline of the course:
Algorithms' time and space asymptotic complexity. Main Theorem. Amortized complexity.
Brute Force. Backtrack. Divide and Conquer. Dynamic programming. Comparison and non-comparison sort algorithms. Sweep line algorithms. Graph Theory Algorithms.
Data structures – queue, stack, priority queue, heap, prefix sum, binary search trees, interval trees, union & find, trie.

Recommended literature:
1, Laaksonen A.: Guide to Competitive Programming: Learning and Improving Algorithms Through Contests (Undergraduate Topics in Computer Science), Springer, 2017, ISBN 978-3319725468
2, Forišek M., Steinová M.: Explaining Algorithms Using Metaphors. Springer Briefs in Computer Science, Springer (2013), ISBN 978-1-4471-5018-3
3, R. Sedgewick, K. Wayne: Algorithms (4th Edition), Addison-Wesley Professional, 2011, ISBN 978-0321573513, http://algs4.cs.princeton.edu/home/
4, Open Data Structures: http://opendatastructures.org/

Course language:
Slovak or english

Notes:
Content prerequisities:
- programming skills in some programming language (Python/Java/C++/...)
- mathematics:
-- computing with polynomials, logarithmic and exponential functions
-- computing limits of sequences, L'Hospital rule

Course assessment
Total number of assessed students: 209

A	B	C	D	E	FX
12.44	5.74	18.18	26.32	34.45	2.87

Provides: RNDr. Rastislav Krivoš-Belluš, PhD.

Date of last modification: 08.01.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/ AFJ1a/15	**Course name:** Automata and formal languages

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: 4

Recommended semester/trimester of the course: 4.

Course level: I., N

Prerequisities:

Conditions for course completion:
Oral examination.

Learning outcomes:
To provide theoretical background for studying computer science in general, by giving the necessary knowledge in theory of automata.

Brief outline of the course:
1: Chomsky hierarchy of grammars: alphabet, symbol (letter, character), transitive closure, word (string), empty word (empty string), length of a string, concatenation, language, grammar, nonterminal symbol, terminal symbol, initial nonterminal (initial symbol), grammar rule, derivation step, language generated by a grammar, Chomsky hierarchy of grammars - phrase-structure, context sensitive, context free, regular
2: Deterministic finite state automata: finite state automaton, state, input symbol, output symbol, initial state, transition function, output function, examples of automata and their graphic representation, generalized transition and output functions and their basic properties
3: Reduction of automata I: equivalent automata, minimal (optimal) automaton, reachable state, properties of reachable states, elimination of unreachable states
4: Reduction of automata II: equivalent states, k-equivalent states, properties of equivalence and k-equivalence, relation between k-equivalence and (k+1)-equivalence, partitioning the state set into equivalence classes, elimination of equivalent states
5: Reduction of automata III: proof of correctness, unambiguity, and optimality of reduced automaton, testing equivalence of two automata
6: Deterministic finite state acceptors: basic definitions, language recognized by a finite state acceptor, common properties of acceptors and automata with an output, minimizing a finite state acceptor
7: Operations with regular languages: complement, intersection, union, difference, symmetric difference, testing of emptiness, inclusion, equality, and disjointness for regular languages
8: Nondeterministic finite state acceptors: definition, transition function, language recognized by a nondeterministic acceptor, elimination of nondeterminism
9: epsilon-acceptors: definition, properties, elimination of epsilon-transitions

10: Regular grammars: regular grammar, extended regular grammar, transformation of acceptor to a regular grammar, transformation of extended regular grammar to an epsilon-acceptor
11: Regular expressions I: basic properties, transformation of regular expression to an epsilon-acceptor
12: Regular expressions II: regular equations, valid algebraic manipulations with regular expressions, solving an equation with a single unknown variable, solving a system of regular equations, transformation of acceptor to a regular expression
13: Another constructions: review of transformations among various representations, an example of a direct transformation of a grammar to a regular expression, closure of the class of regular languages under another language operations – concatenation and Kleene star, mirror image
14: Another operations: homomorphism and inverse homomorphism, a context-free language that is not regular

Recommended literature:

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.

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 928

A	B	C	D	E	FX
27.16	18.32	23.6	16.49	9.7	4.74

Provides: prof. RNDr. Viliam Geffert, DrSc., RNDr. Juraj Šebej, PhD.

Date of last modification: 23.11.2021

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/ AFJ1b/15	**Course name:** Automata and formal languages

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: 5

Recommended semester/trimester of the course: 5.

Course level: I.

Prerequisities: ÚINF/AFJ1a/15

Conditions for course completion:
Test and oral examination.

Learning outcomes:
To provide theoretical background for studying computer science in general, by giving the necessary knowledge in theory of automata.

Brief outline of the course:
1: Pushdown automata: definition of a pushdown automaton, accepting by final states, accepting by empty pushdown
2: Deterministic pushdown automata: examples of application in practice
3: Context-free grammars: basic definition, leftmost derivation, derivation tree, elimination of rules of type A→epsilon and A→B, Chomsky normal form
4: Relation between context-free grammars and pushdown automata: transforming context-free grammar to a pushdown automaton, transforming pushdown automaton to a context-free grammar
5: Pumping lemma I: Statement of the lemma and its proof
6: Pumping lemma II: applications of the lemma
7: Closure properties of context-free languages
8: Closure properties of deterministic context-free languages
9: Pushdown automata producing an output: basic definitions and properties, applications in practice
10: Context-sensitive languages: context-sensitive grammar, nondeterministic linear-bounded Turing machine (LBA), transforming context-sensitive grammar to an LBA, transforming LBA to a context-sensitive grammar
11: Closure properties of context-sensitive languages
12: Recursively enumerable languages: phrase-structure grammar, nondeterministic and deterministic Turing machine, transforming nondeterministic Turing machine to a phrase-structure grammar, transforming phrase-structure grammar to a deterministic Turing machine, closure properties
13: Universal Turing machine
14: Algorithmically undecidable problems of the formal language theory

Recommended literature:

1. J.E. Hopcroft, R.Motwani, J.D. Ullman: Introduction to automata theory, languages, and computation, Addison-Wesley, 2001.
2. J. Shallit: A second course in formal languages and automata theory, Cambridge University press, 2009.
3. M. Sipser: Introduction to the theory of computation, Thomson Course Technology, 2006.

Course language:
Slovak or English

Notes:
Content prerequisities:
1. Basic mathematical background (proof by contradicion and by mathematical induction), basic notions from the set theory (union, intersection, complement, cartesian product).
2. Basic knowledge about finite state automata and regular languages.

Course assessment
Total number of assessed students: 616

A	B	C	D	E	FX
38.15	17.05	19.81	16.56	6.01	2.44

Provides: prof. RNDr. Viliam Geffert, DrSc., RNDr. Juraj Šebej, PhD.

Date of last modification: 23.11.2021

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ BPOA/22	**Course name:** Bachelor Thesis and its Defence
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: I.	
Prerequisities: ÚINF/SZPb/22	
Conditions for course completion: The bachelor thesis is the result of the student's own work. 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 supervision process and in the process of thesis defense. Failure to do so is reason for disciplinary action.	
Learning outcomes: The bachelor's thesis demonstrates mastery of the basics of 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 field problems. The bachelor thesis may have elements of compilation. The student demonstrates the ability of independent professional work in terms of content, formal and ethical. Further details on the bachelor thesis are determined by Directive no. 1/2011 on the basic requirements of final theses and the Study Regulations of UPJŠ in Košice for the 1st, 2nd and combined 1st and 2nd degree.	
Brief outline of the course: 1. Elaboration of the bachelor thesis in accordance with the instructions of the supervisor. 2, Presentation of the results of the bachelor's thesis before the examination commission. 3. Answering questions related to the topic of the bachelor thesis within the discussion.	
Recommended literature: The recommended literature is determined individually in accordance with the topic of the bachelor's thesis.	
Course language: Slovak and optionally English.	
Notes:	

Course assessment
Total number of assessed students: 4

A	B	C	D	E	FX
50.0	25.0	25.0	0.0	0.0	0.0

Provides:

Date of last modification: 07.03.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ BKPa/22	**Course name:** Bachelor project I

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

Number of ECTS credits: 1

Recommended semester/trimester of the course: 5.

Course level: I.

Prerequisities:

Conditions for course completion:
To prepare and present a contribution related to thesis and its topic.

Learning outcomes:
To get students familiar with basic knowledge on the form and content of thesis and thesis presentation as well as with the support for its realisation.

Brief outline of the course:
Necessary elements and formal aspects of a thesis. WYSIWYG editors, LaTeX, drawing programs. Presentation software, Microsoft PowerPoint and its clones, Beamer. Suggestions for presentation and contribution making.

Recommended literature:
electronic information sources

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 134

abs	n
100.0	0.0

Provides: prof. RNDr. Ondrej Hutník, PhD.

Date of last modification: 24.08.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ BKPb/22	**Course name:** Bachelor project II
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: 6.	
Course level: I.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 112

abs	n
100.0	0.0

Provides:
Date of last modification: 24.08.2022
Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ BPO/14	**Course name:** Bachelor thesis and its defence
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: I.	
Prerequisities:	
Conditions for course completion: The bachelor thesis is the result of the student's own work. 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 supervision process and in the process of thesis defense. Failure to do so is reason for disciplinary action.	
Learning outcomes: Evaluation of student‘s competences with respect to the profile of the graduate.The bachelor's thesis demonstrates mastery of the basics of 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 field problems. The bachelor thesis may have elements of compilation. The student demonstrates the ability of independent professional work in terms of content, formal and ethical. Further details on the bachelor thesis are determined by Directive no. 1/2011 on the basic requirements of final theses and the Study Regulations of UPJŠ in Košice.	
Brief outline of the course: 1. Elaboration of the bachelor thesis in accordance with the instructions of the supervisor. 2. Presentation of the results of the bachelor's thesis before the examination commission. 3. Answering questions related to the topic of the bachelor thesis within the discussion.	
Recommended literature: The recommended literature is determined individually in accordance with the topic of the bachelor's thesis.	
Course language: Slovak	
Notes:	

Course assessment
Total number of assessed students: 202

A	B	C	D	E	FX
66.83	18.81	8.42	3.47	1.98	0.5

Provides:

Date of last modification: 19.04.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: CJP/ PFAJKKA/07	**Course name:** Communicative Competence in English

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:

Course level: I.

Prerequisities:

Conditions for course completion:
Active participation in class and completed homework assignments. Students are allowed to miss two classes at the most.
2 credit tests (presumably in weeks 6/7 and 12/13) and an oral presentation in English.
Final evaluation consists of the scores obtained for the 2 tests (50%).
Final grade will be calculated as follows: A 93-100 %, B 86-92%, C 79-85%, D 72-78%, E 65-71%, FX 64 % and less.

Learning outcomes:

Brief outline of the course:

Recommended literature:
www.bbclearningenglish.com
Štěpánek, Libor a kol. Academic English-Akademická angličtina. Praha: Grada Publishing, a.s., 2011.
McCarthy M., O'Dell F.: English Vocabulary in Use, Upper-Intermediate. CUP, 1994.
Fictumova J., Ceccarelli J., Long T.: Angličtina, konverzace pro pokročilé. Barrister and Principal, 2008.
Peters S., Gráf T.: Time to practise. Polyglot, 2007.
Jones L.: Communicative Grammar Practice. CUP, 1985.
Additional study materials.

Course language:
English language, B2-C1 level according to CEFR

Notes:

Course assessment
Total number of assessed students: 303

A	B	C	D	E	FX
45.21	21.12	17.49	7.59	5.94	2.64

Provides: Mgr. Barbara Mitríková, Mgr. Viktória Mária Slovenská

Date of last modification: 06.02.2025
Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: CJP/ PFAJGA/07	**Course name:** Communicative Grammar in English

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:

Course level: I.

Prerequisities:

Conditions for course completion:
Active classroom participation (maximum 2 absences tolerated), homework assignments completed by given deadlines.
Presentation of a topic related to the study field.
Final Test - end of semester, no retake
Final assessment = average of test and presentation.
Grading scale: A 93-100%, B 86-92%, C 79-85%, D 72-78%, E 65-71%, FX 64% and less

Learning outcomes:
The development of students´ language skills - reading, writing, listening, speaking, improvement of their communicative 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 on level B2.

Brief outline of the course:
Selected aspects of English grammar and pronunciation
Word formation
Contrast of tenses in English
The passive voice
Types of Conditionals
Phrasal verbs and English idioms
Words order and collocations, prepositional phrases

Recommended literature:
Vince M.: Macmillan Grammar in Context, Macmillan, 2008
McCarthy, O'Dell: English Vocabulary in Use, CUP, 1994
www.linguahouse.com
esllibrary.com
bbclearningenglish.com
ted.com/talks

Course language:

English language, level B2 according to CEFR.

Notes:

Course assessment
Total number of assessed students: 446

A	B	C	D	E	FX
41.48	19.51	15.7	7.85	5.61	9.87

Provides: Mgr. Viktória Mária Slovenská, Mgr. Lýdia Markovičová, PhD.

Date of last modification: 08.02.2025

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: KGER/ NJKG/07	**Course name:** Communicative Grammar in German Language

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:

Course level: I.

Prerequisities:

Conditions for course completion:
Active participation in class and completed homework assignments. Students are allowed to miss 2 classes at the most (2x90 min.). 2 control tests during the semester. Final grade will be calculated as follows: A 93-100 %, B 86-92%, C 79-85%, D 72-78%, E 65-71%, FX 64 % and less.

Learning outcomes:
The aim of the course is to identify and eliminate the most frequent grammatical errors in oral and written communication, learning language skills of listening comprehension, speaking, reading and writing, increasing students 'language competence (acquisition of selected phonological, lexical and syntactic knowledge), development of students' pragmatic competence (acquisition of the ability to express selected language functions), development of presentation skills, etc.

Brief outline of the course:
The course is aimed at practicing and consolidating knowledge of morphology and syntax of German in order to show the context in grammar as a whole. The course is intended for students who often make grammatical errors in oral as well as written communication. Through the analysis of texts, audio recordings, tests, grammar exercises, monologic and dialogical expressions of students focused on specific grammatical structures, problematic cases are solved individually and in groups. Emphasis is placed on the balanced development of grammatical thinking in the communication process, which ultimately contributes to the development of all four language skills.

Recommended literature:
Dreyer, H. – Schmitt, R.: Lehr- und Übungsbuch der deutschen Grammatik. Hueber Verlag GmbH & Co. Ismaning, 2009.
Krüger, M.: Motive Kursbuch, Lektion 1 – 30. Huebert Verlag GmbH & Co. Ismaning, 2020.
Brill, L.M. – Techmer, M.: Deutsch. Großes Übungsbuch. Wortschatz. Huebert Verlag GmbH & Co. Ismaning, 2011.
Földeak, Hans: Sag's besser!. Grammatik. Arbeitsbuch für Fortgeschrittene. Huebert Verlag GmbH & Co. Ismaning, 2001.
Geiger, S. – Dinsel, S.: Deutsch Übungsbuch Grammatik A2-B2. Huebert Verlag GmbH & Co. Ismaning, 2018.
Dittelová, E. – Zavatčanová, M.: Einführung in das Studium der deutschen Fachsprache. Košice: ES UPJŠ, 2000.

Course language:
German, Slovak language

Notes:

Course assessment
Total number of assessed students: 58

A	B	C	D	E	FX
62.07	10.34	8.62	3.45	8.62	6.9

Provides: Mgr. Ulrika Strömplová, PhD.

Date of last modification: 13.08.2024

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/PSIN/15	**Course name:** Computer network Internet

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: 3 / 1 **Per study period:** 42 / 14
Course method: present

Number of ECTS credits: 5

Recommended semester/trimester of the course: 4., 6.

Course level: I., N

Prerequisities: ÚINF/PAZ1a/15 or ÚINF/PRG1/15

Conditions for course completion:
Activity at excercises (max 18 points), home work (max 18 points), test (max 30 points).
Verbal exam (min 25 points, max 50 points). Required minimum for passing the course is 55 points.

Learning outcomes:
Students will get the informations about principles and achitecture of Internet. They will understand the principles of ISO/OSI layers reference model for network communication. They will understand the meaning and usage of terms protocol, service, interface. They will analyze the parameters of communication channels, understand the function of interconnection devices (hub, switch, router). They will understand the structure of IP packets, addressing and how packets are transmitted, the principle of routing protocols and the creation of routing tables. They will understand the priciples of acknowledged TCP transport transmission and its implementation. They will know how to use the interface of UDP and TCP protocols in a program code. They will understand the basic application protocols of the Internet.

Brief outline of the course:
1. Introduction to computer networks, internet connection types, delay and loss in packet-switched networks, ISO OSI reference model and TCP/IP protocols family.
2. Application layer: Web and HTTP, protocol FTP ,e-mail and protocols SMTP, POP3, IMAP,
3. Application layer: domain names and DNS, Peer-to-peer applications. Security in computer networks.
4. Transport layer: services, multiplexing and demultiplexing, protocol UDP, reliable data transfer
5. Transport layer: connection oriented transport protocol TCP, flow and congestion control.
6. Network Layer: Internet protocol IPv4, virtual circuit and datagram networks, packet fragmentation, routing table, application protocol DHCP
7. Network Layer: network address translation NAT, ICMP protocol, internet protocol IPv6
8. Network Layer: routing algorithms and protocols, broadcast and multicast routing
9. Link layer: error detection, multiple access methods CSMA/CD and CSMA/CA, Ethernet, frames, protocols ARP and RARP, link layer addressing
10. Link Layer and wireless and mobile networks: hub, switch, virtual LAN, 802.11 Wireless LAN, Bluetooth 802.15, WiMAX 802.16, Mobile IP, mobility in GSM
11. Physical Layer: Communication channels parameters, digital and analog encoding.

Recommended literature:

1. J. F. Kurose, Keith W. Ross: Computer Networking: A Top-Down Approach, 7. edition, 2016
2. A. S. Tanenbaum: Computer Networks, 5. edition, Pearson, 2010
3. W. Stallings: Local and Metropolitan Area Networks, Prentice Hall, 2000
4. E. Comer, R.E. Droms: Computer Networks and Internets, Prentice Hall, 2003
5. W. R. Stevens: TCP/IP Illustrated, Vol.1: The Protocols, Addison-Wesley, 1994

Course language:

Slovak or English

Notes:

Content prerequisities: basic programming skills in Java

Course assessment

Total number of assessed students: 316

A	B	C	D	E	FX
10.76	8.54	19.62	19.94	30.06	11.08

Provides: RNDr. Peter Gurský, PhD., RNDr. Richard Staňa

Date of last modification: 04.01.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ KOP/10	**Course name:** Convex programming

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: 3 / 1 **Per study period:** 42 / 14
Course method: present

Number of ECTS credits: 5

Recommended semester/trimester of the course: 6.

Course level: I., II.

Prerequisities: ÚMV/LCO/10 and (ÚMV/MAN1c/22 or ÚMV/MAN2d/22 or ÚMV/FRPb/19)

Conditions for course completion:
To complete the course, it is necessary to demonstrate the ability to formulate definitions and theorems from the lectured material, to demonstrate the proofs of theorems and to solve selected problems of convex resp. nonlinear programming.
The overall evaluation of the course is awarded on the basis of semester evaluation (which includes the completion of two semester tests focusing on problem solving; for each of them, a maximum of 25 points can be obtained) and the results of an oral exam (consisting of three questions of a theoretical nature, with a total of 50 points). To pass the exam, it is necessary to obtain more than half of the maximum number of 100 points (otherwise the test is evaluated by FX), whereby evaluation E is given in case of point gain 51-59, D in case of 60-69, C in case of 70-79, B in the case of 80-89 and A in the case of more than 90 points.

Learning outcomes:
After completing the course, the student is acquainted with the basics of nonlinear programming from both theoretical point of view (the topics include properties of convex sets, properties of convex functions, optimality conditions for nonlinear problems, Karush-Kuhn-Tucker theory, quadratic programming), as well as from practical one (illustrations of real problems with underlying models that use nonlinear programming, and methods of their solution using computer algebra systems and computer technology).

Brief outline of the course:
Week 1: Practical problems leading to nonlinear programs.
Week 2 - 3: Convex sets and their properties.
Week 4 - 6: Convex functions – properties and criteria of convexity.
Week 7 - 8: Necessary and sufficient conditions of optimality. Karush-Kuhn-Tucker conditions.
Week 9 - 10: Quadratic programming. Duality in nonlinear programming.

Recommended literature:
M. Hamala, M. Trnovská: Nelineárne programovanie, Epos, 2012
M.S. Bazaraa, H.D. Sherali, C.M. Shetty: Nonlinear Programming: Theory and Algorithms, 3rd edition, Wiley-Interscience, 2006

Course language:
Slovak or English

Notes:
Knowledge of the basics of differential calculus of functions of one and more variables, linear algebra and linear programming (simplex method) is required.

Course assessment
Total number of assessed students: 93

A	B	C	D	E	FX
15.05	13.98	9.68	12.9	48.39	0.0

Provides: prof. RNDr. Tomáš Madaras, PhD., RNDr. Alfréd Onderko, PhD.

Date of last modification: 19.04.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ ADA/19	**Course name:** Data analysis

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: 1 / 3 **Per study period:** 14 / 42
Course method: present

Number of ECTS credits: 4

Recommended semester/trimester of the course: 2.

Course level: I.

Prerequisities: ÚMV/UAD/10

Conditions for course completion:
Test (30p) and individual project work (20p).
Oral presentation of the individual project work (5p).
At least 50% must be obtained from each part.
Final evaluation: ≥90% A; ≥80% B; ≥70% C; ≥60% D; ≥50% E; <50% FX.

Learning outcomes:
Students will gain practical skills in applying basic statistical methods of estimating and testing on real data using statistical software. At the same time, they will develop a concrete idea of the basic statistical concepts and methods discussed from a theoretical point of view in the following subjects.

Brief outline of the course:
1. Data visualization using statistical software R.
2. Basic principles of statistical inference. Random sample from normal distribution, q-q plot, testing of normality.
3. Confidence intervals for proportions.
4. Confidence intervals for means.
5. Testing hypotheses about proportions.
6. Testing hypotheses about means.
7. Relationships between quantitative variables. Linear regression, multiple regression.
8. Data visualization using Python (part I).
9. Relationships between qualitative variables. Goodness-of-Fit tests and contingency tables.
10. Analysis of variance (principle, testing, graphical representation).
11. Data visualization using Python (part II).
12. Nonparametric methods of testing.

Recommended literature:
1. Utts, J.M., Heckard, R.F. (2021), Mind od Statistics, 6th ed., Thomson Brooks/Cole
2. Peck, R., Short, T. (2019), Statistics: Learning from Data, 2nd ed., Cengage Learning
3. Crawley, M.J. (2014), Statistics: An Introdution using R, New York: Wiley
4. Wickham, H. (2016), ggplot2: Elegant Graphics for Data Analysis, 2nd ed. Springer
5. VanderPlas, J. (2023), Python Data Science Handbook, O'Reilly Media
6. Anděl J. (2011): Základy matematické statistiky, MatfyzPress, Praha (in Czech)

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 62

A	B	C	D	E	FX
64.52	17.74	12.9	3.23	1.61	0.0

Provides: doc. RNDr. Martina Hančová, PhD.

Date of last modification: 21.11.2024

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ PDA/19	**Course name:** Data analysis project I
Course type, scope and the method: **Course type:** Practice **Recommended course-load (hours):** **Per week:** 4 **Per study period:** 56 **Course method:** present	
Number of ECTS credits: 4	
Recommended semester/trimester of the course: 4.	
Course level: I., N	
Prerequisities:	
Conditions for course completion: Active presentation of the results of the data analysis project and the bachelor thesis. Presentation of results from published foreign papers.	
Learning outcomes: Knowledge and skills associated with the phases of data analysis and their use in solving specific tasks. Knowledge of selected procedures in the field of data analysis, machine learning and artificial intelligence. Development of understanding of professional text in the field of data analysis and its interpretation.	
Brief outline of the course: 1. - 2. Phases of data analysis projects and selected basic terms 3. - 4. Selection and specification of data analysis projects 5. - 7. Selected methods of data analysis 8. - 11. Consultations on data analysis projects and bachelor theses 12. - 13 Applications of data analysis methods in various fields	
Recommended literature: 1. AGGARWAL, Charu C. Data mining: a textbook. Cham: Springer, 2015. ISBN 978-3-319-14141-1. 2. ALPAYDIN, Ethem. Introduction to machine learning. 3rd ed. Massachusetts: MIT Press, 2014. ISBN 978-0-262-02818-9. 3. RASCHKA, Sebastian, Mirjalili, Vahid. Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2, 3rd Edition, Packt Publishing Ltd., 2019. ISBN 978-1789955750. 4. WITTEN, I. H., Eibe FRANK a Mark A. HALL. Data mining: practical machine learning tools and techniques. 4th ed. Amsterdam: Morgan Kaufmann, 2017. Morgan Kaufman series in data management systems. ISBN 9780128042915. 5. Literature associated with particular project.	
Course language: Slovak or English	
Notes:	

Course assessment
Total number of assessed students: 23

A	B	C	D	E	FX
91.3	0.0	0.0	0.0	8.7	0.0

Provides: doc. RNDr. Ľubomír Antoni, PhD., RNDr. Keerthi Kumar Doreswamy, PhD.

Date of last modification: 25.01.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/ DBS/15	**Course name:** Database systems for Mathematicians

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: 3 / 2 **Per study period:** 42 / 28
Course method: present

Number of ECTS credits: 6

Recommended semester/trimester of the course: 3.

Course level: I., II.

Prerequisities:

Conditions for course completion:
Demonstration of adequate mastery of the content standard of the subject in the ongoing and final evaluation, the ability to formulate a problem in the acquired terminology and solve it within a project.
Written works during the semester, project.
Written and oral exam.

Learning outcomes:
After completing the course, the student acquires the principles of relational databases, is able to apply standard data models, design relational databases and formulate filtering queries.

Brief outline of the course:
1) Relational databases. Query language SQL, filtering; Stored procedures.
2) Data types, operators, numerical, string and time functions; System and user functions.
3) JOIN operations; Views. CTE.
4) AGGREGATION AND GROUP BY; Recursion and transitive closure.
5) Data and database models. Relational scheme. RDB principles. Data integrity; Transactions.
6) DB design, ER diagrams; Triggers and integrity.
7) System commands about DB and tables. Cascading deletion and update; Cursors.
8) Nested queries. ROLLUP. CASE expression; Physical organization of data.
9) Three-valued logic. Quantifiers and NOT. Set operations; B-trees and indexes.
10) Data science and knowledge acquisition using R; Functional dependencies.
11) Data warehouses. Data cube. Pivot table.
12) Relational algebra. Normalization of relational databases; The latest normal form - ETNF.

Recommended literature:
- C.J. Date, Database Design and Relational Theory, 2012, O'Reilly Media, Inc., ISBN: 978-1-449-32801-6
- J. Murach, Murach's MySQL, 3rd Edition, 2019, Mike Murach & Associates, Inc., ISBN-10: 1943872368
- R. Ramakrishnan, J. Gehrke, Database Management Systems, 2020, McGraw-Hill, ISBN13 9780071231510
- S. Krajčí: Databázové systémy, UPJŠ, 2005

- I. Ben-Gan, D. Sarka, A. Machanic, K. Farlee, T-SQL Querying, 2015, Microsoft Press, ISBN: 978-0-7356-8504-8
- I. Ben-Gan, T-SQL Fundamentals, Third Edition, 2016, Microsoft Press, ISBN: 978-1-5093-0200-0

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 745

A	B	C	D	E	FX
13.02	10.07	13.96	20.4	32.62	9.93

Provides: doc. RNDr. Csaba Török, CSc., RNDr. Lukáš Miňo, PhD.

Date of last modification: 08.01.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ RPR/22	**Course name:** Decision processes

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: 5

Recommended semester/trimester of the course: 6.

Course level: I., II.

Prerequisities:

Conditions for course completion:
The evaluation is given on the basis of elaboration of individual projects related to the topics covered within the subject.

Learning outcomes:
After completing the course, the student has the knowledge on basics of decision theory (games against nature), selected methods of solving multicriterial optimization problems together with advanced topics in decision-making theory (use of non-additive measures and generalized integrals).

Brief outline of the course:
Weeks 1 -2: Basics of decision theory, games against nature: examples of practical problems, decision criteria.
Week 3: Decision trees and their applications.
Weeks 4 - 8: Multicriterial optimization: examples of practical problems, methods for evaluating the importance of variant assessment criteria, methods for determining compromise and optimal variants.
Week 9: Utility function, decision-making under risk and uncertainty.
Weeks 10 - 11: Non-additive measures, their interpretation and the Choquet integral in the decision-making process, other selected non-additive methods.
Week 12: CEU, RDEU method and the Choquet-Stieltjes integral, paradoxes (Allais and Ellsberg paradox).

Recommended literature:
Grabisch, M.: Set Functions, Games and Capacities in Decision Making. Theory and Decision Library C~46, Springer International Publishing Switzerland, 2016.
Greco, S., Ehrgott, M., Figueira, J.-R.: Multiple Criteria Decision Analysis: State of the Art Surveys, International Series in Operations Research & Management Science, 233, Springer; 2nd ed. 2016.

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 14

A	B	C	D	E	FX
35.71	14.29	14.29	21.43	14.29	0.0

Provides: prof. RNDr. Tomáš Madaras, PhD., RNDr. Lenka Halčinová, PhD.

Date of last modification: 19.04.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ DSMa/10	**Course name:** Discrete mathematics I
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: 5	
Recommended semester/trimester of the course: 3.	
Course level: I.	
Prerequisities:	
Conditions for course completion: Examination.	
Learning outcomes: To be familiar with some factual knowledge of combinatorics and graph theory. To understand an appreciate mathematical notions, definitions, and proofs, to solve problems requiring more than just standard recipes, and to express mathematical thoughts precisely and more rigorously.	
Brief outline of the course: Basic principles. Counting and binomial coefficients, Binomial theorem, polynomial theorem. Recurrence: Some miscellaneous problems, Fibonacci-type relations, Using generating functions, miscellaneous methods. The inclusion-exclusion principle. Rook polynomials. Introduction to graphs: The concept of graphs, paths in graphs. Connectivity. Trees, bipartite graphs. Planarity. Polyhedra. Traveling round a graph: Eulerian graphs, Hamiltonian graphs. Partitions and colourings: Vertex colourings of graphs. Edge colourings of graphs	
Recommended literature: 1. I. Anderson, A first course in discrete mathematics, Springer-Verlag London, 2001. 2. J. Matoušek and J. Nešetřil, Invitation to discrete mathematics, Oxford University Press Inc. , New York 1999. 3. S. Jendroľ, P. Mihók: Diskrétna matematika I, UPJŠ Košice 1992.	
Course language: Slovak	
Notes:	

Course assessment
Total number of assessed students: 792

A	B	C	D	E	FX
13.26	13.13	16.54	19.95	30.3	6.82

Provides: doc. RNDr. Roman Soták, PhD., RNDr. Alfréd Onderko, PhD.

Date of last modification: 16.04.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ DSMb/10	**Course name:** Discrete mathematics II

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: 5

Recommended semester/trimester of the course: 4.

Course level: I.

Prerequisities: ÚMV/DSMa/10 or ÚMV/DSM3a/10

Conditions for course completion:
In the covered areas of graph theory, the ability to formulate definitions and statements, to present proofs of statements, to explain individual steps in proofs and to solve selected problems related to given topics is required.
During the semester (continuous assessment) two tests take place, from which 50% of points can be obtained, and from the oral exam alike 50% can be obtained. Evaluation: A ... at least 90%, B ... at least 80%, C ... at least 70%, D ... at least 60%, E ... at least 50%, FX ... less than 50% .

Learning outcomes:
Acquired knowledge of basic areas of graph theory, overview of used objects and properties, understanding of important statements and methods, knowledge of possible applications and the ability to formulate and solve problems in this area.

Brief outline of the course:
- (week 1) Introduction to graphs (graph relations, graph operations, special graph classes)
- (week 2-3) Connectivity and distance in graphs (connectedness of vertices, eccentricity, incidence matrix)
- (week 4) (Spanning) Trees (trees isomorphism)
- (week 5-6) Connectivity in graphs (vertex and edge k-connectedness)
- (week (7-8) Independence and coverings (independent set, matching, vertex and edge covering)
- (week 9-10) Extremal graph theory (Ramsey numbers, Turán graphs)
- (week 11-13) Graph colorings (vertex coloring, chromatic polynomial, edge coloring)
- (week 14) Directed graphs (strong/weak connectedness, tounaments, acyclic graphs)

Recommended literature:
1. A. Bondy, U.S.R. Murty, Graph theory, Springer, 2008
2. G. Chartrand, L. Lesniak, P. Zhang, Graphs and digraphs, CRC Press, 2011
3. R. Diestel, Graph Theory, Springer, 2017
4. D. West, Introduction to Graph Theory, Pearson, 2001

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 247

A	B	C	D	E	FX
14.57	11.74	25.1	24.7	18.62	5.26

Provides: RNDr. Igor Fabrici, Dr. rer. nat., RNDr. Alfréd Onderko, PhD.

Date of last modification: 16.04.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ DSMc/10	**Course name:** Discrete mathematics III

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: 5

Recommended semester/trimester of the course: 5.

Course level: I.

Prerequisities: ÚMV/DSMb/10

Conditions for course completion:
To complete the course, it is necessary to demonstrate the ability to formulate definitions and statements from the lectured material, to understand the relationship between them, to demonstrate the proofs of statements and solve selected problems based on the presented areas of graph theory. The evaluation is given on the basis of semester assessment, activity in exercises and the result of an exam consisting of a final test and an oral part. The semester assessment takes the form of two written tests (focusing on exercises related to the lectured material) during the semester; a maximum of 25 points can be obtained for each of them. A maximum of 50 points can be obtained for the final test and a maximum of 25 points for the oral part of the exam (consisting of two theoretical questions). During the semester, each student can get a maximum of 10 bonus points for the active approach presented at the seminars on the subject.
The summary evaluation is calculated by the formula max {max {a, b} + c, a + b + c / 2} + d + e, where a resp. b is the number of points obtained from the semester tests, c is the number of points from the final test, d is the number of points for the oral part of the exam, and e are points for activity at the seminars. To pass the exam, it is necessary to obtain a total of at least 50 points (otherwise the exam is evaluated by FX), while the rating E is given in the case of points 51-59, D in the case of 60-69, C in the case of 70-79, B in the case of 80-89 and A in the case of more than 90 points.

Learning outcomes:
After completing the course, the student is acquainted (following the prerequisity subject Discrete Mathematics I and II) with other core topics and results of graph theory, which will give the comprehensive insight and knowledge of this area of mathematics.

Brief outline of the course:
Week 1: Advanced graph models of structures from different areas of science.
Week 1 and 2: Eulerian and hamiltonian graphs.
Week 3 and 4: Measures of connectivity in graphs, Menger theorem and its corollaries.
Week 5: Perfect matchings, Tutte theorem.
Week 6 and 7: Planar graphs and their basic properties, Euler formula and its corollaries.
Week 8: Characterization of planar graphs, theorem of Kuratowski.
Week 9: Structural properties of planar and polyhedral graphs.
Week 10: Chromaticity of planar graphs.

Week 11: Measures of graph nonplanarity I - crossing number and its estimates, crossing lemma.
Week 12: Measures of graph nonplanarity II - the genus of graph, Eulerova theorem for embedded graphs, chromaticity of embedded graphs.
Week 13: Edge colorings, Vizing theorem

Recommended literature:
D.B. West: Introduction to graph theory (2nd edition), Prentice Hall 2001
A. Bondy and U.S.R. Murty: Graph theory, Springer-Verlag 2008
G. Chartrand, L. Lesniak, and P. Zhang, Graphs and digraphs, CRC Press 2011
R. Diestel: Graph Theory (4th edition), Springer-Verlag 2010

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 95

A	B	C	D	E	FX
18.95	28.42	14.74	24.21	13.68	0.0

Provides: prof. RNDr. Tomáš Madaras, PhD., RNDr. Alfréd Onderko, PhD.

Date of last modification: 21.11.2024

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ DYS/19	**Course name:** Dynamic systems

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: 5

Recommended semester/trimester of the course: 5.

Course level: I.

Prerequisities: ÚMV/MANb/19 or ÚMV/MAN2b/22 or ÚMV/FRPb/19

Conditions for course completion:
Ongoing evaluation takes the form of a written test during the semester. The overal evaluation is based on a result of mid-term evaluation (60%) and the result of final written and oral examination (40%).

Learning outcomes:
The course provides students deep knowledge of the theory of dynamical systems from the theoretical and practical point of view (their modeling, their properties and numerical simulation). Emphasis is put on an interdisciplinary approach and hte usage of software.

Brief outline of the course:
1. Basic notions of the theory of dynamical systems and their properties.
2. Differential equations of n-th order and systems of differential equations - their relationship, methods of solution.
3. Difference equations and systems - methods of solution.
4. Existence, uniqueness and continuation of Cauchy problem.
5. Stability and chaotic behavior of the dynamical systems, bifurcation.
6. Numerical methods as dynamical systems, analysis of algorithms.
7. Applications of dynamical systems in computer science.

Recommended literature:
1. Brunovský, P. , Diferenčné a diferenciálne rovnice (vysokoškolský učebný text), FMFI UK, 2011
http://www.iam.fmph.uniba.sk/skripta/brunovsky/ddrtext.pdf
2. L. Kluvánek, I. Mišík, M. Švec: Matematika II, SVTL, Bratislava, 1961.
3. N. M. Matvejev: Zbierka príkladov z obyčajných diferenciálnych rovníc, ALFA, Bratislava,
4. Stuart, A.M.; Humphries, A.R. (1996), Dynamical Systems and Numerical Analysis, Cambridge University Press
5. Jacques M. Bahi and Christophe Guyeux. 2013. Discrete Dynamical Systems and Chaotic Machines: Theory and Applications. CRC Press, Inc., Boca Raton, FL, USA. 1970.
6. Kelley, C. T. (1995). Iterative Methods for Linear and Nonlinear Equations. SIAM.
7. Kelley, C.T. (1999) Iterative Methods for Optimization. In: Frontiers in Applied Mathematics, Vol. 18, SIAM

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 182

A	B	C	D	E	FX
21.43	21.98	14.84	21.98	16.48	3.3

Provides: doc. Mgr. Jozef Kiseľák, PhD.

Date of last modification: 15.04.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ FRPa/19	**Course name:** Function of real variable

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: 2 / 4 **Per study period:** 28 / 56
Course method: present

Number of ECTS credits: 7

Recommended semester/trimester of the course: 1.

Course level: I.

Prerequisities:

Conditions for course completion:
Continuous assessment of student's work during the semester (submission of compulsory homework, writing three tests). Final test and oral discussion on the topics of the subject.

Learning outcomes:
The course provides an introductory knowledge on basic tools of differential and integral calculus of real functions of one real variable, and a development of certain calculation skills in the field.

Brief outline of the course:
1. Basics of mathematical logic and notations (1 week)
2. Real functions - basic notions, operation, graphs and their transformations (2 weeks)
3. Continuity of a real-valued function (1 week)
4. Derivative of a function using the geometric concepts, rules of differentiation (2 weeks)
5. Basic of differential calculus - relations with monotonicity and convexity, extremas, using in optimisation, geometric and physics tasks (2 weeks)
6. Primitive function, methods of their finding (3 weeks)
7. Newton definite integral - methods of its computation, using in geometric and physics tasks (2 weeks)

Recommended literature:
1. Kulcsár, Š. - Kulcsárová, O.: Zbierka úloh z matematickej analýzy I., UPJŠ, 2002.
2. Kulcsár, Š. - Kulcsárová, O.: Zbierka úloh z matematickej analýzy II., UPJŠ, 2003.
3. Hutník, O. - Kulcsár, Š. - Kulcsárová, O. - Mojsej, I.: Zbierka úloh z matematickej analýzy III., UPJŠ, 2011.
4. Demidovič, B. P.: Sbírka úloh a cvičení z matematické analýzy, Fragment, Praha, 2003.
5. Brannan, D.: A First Course in Mathematical Analysis, Cambridge University Press, Cambridge 2006.
6. Bruckner, A. M., Bruckner J. B., Thomson, B. S.: Real Analysis, Second Edition, ClassicalRealAnalysis.com, 2008.
7. Zorich, V. A.: Mathematical Analysis I, Springer-Verlag 2002.

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 946

A	B	C	D	E	FX
8.25	8.14	17.12	20.3	29.7	16.49

Provides: prof. RNDr. Ondrej Hutník, PhD., RNDr. Lenka Halčinová, PhD., RNDr. Jana Borzová, PhD., RNDr. Miriam Kleinová, PhD., RNDr. Kristína Hurajová

Date of last modification: 16.04.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ FRPb/19	**Course name:** Function of real variables

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: 4 / 3 **Per study period:** 56 / 42
Course method: present

Number of ECTS credits: 8

Recommended semester/trimester of the course: 2.

Course level: I.

Prerequisities: ÚMV/FRPa/19

Conditions for course completion:
Ongoing evaluation takes the form of small tests, projects and one main test during the semester. Overall evaluation is given by ongoing evaluation (60%), written and oral part of the exam (40%).

Learning outcomes:
The course provides students the basics of mathematical analysis necessary to study physics and computer science and related fields. The students also learn mathematical culture, notation and mathematical way of thinking and expression.

Brief outline of the course:
1. Numerical sequences.
2. Metric space, normed space - Euclid space, some topological properties of points and sets.
3. Function of several real variables - basic notions, limit and continuity.
4. Infinite series of numbers.
5. The integral calculus of function of one real variable:
a) Definite Riemann integral - definition, basic properties, calculation methods, classes of integrable functions, applications;
b) improper integral.
6. Differential calculus of functions of one variable. Functional, power and Taylor series of functions of one variable.
7. Ordinary differential equations - basic notions, equations of the first order (equations leading to separable and linear), linear equations of 2nd order with constant coefficients.
8. Differential calculus of functions of several real variables - partial derivative, differentiability and total differential (also of higher order), Taylor polynomial, directional derivative, local and global extrema, constrained local extrema.
9. Double (two-dimensional) integral - definition, calculation, applications.

Recommended literature:
1. B. Mihalíková, J. Ohriska: Matematická analýza 1, 2, vysokoškolský učebný text, UPJŠ v Košiciach, Košice, 2000, 2007.
2. L. Kluvánek, I. Mišík, M. Švec: Matematika I, II, SVTL, Bratislava, 1959.
3. Z. Došlá, O. Došlý: Diferenciální počet funkcí více proměnných, vysokoškolský učebný text, Masarykova univerzita v Brne, Brno, 2003.

4. J. Kopáček: Matematická analýza nejen pro fyziky I, II, Matfyzpress, Praha, 2004, 2007.
5. J. C. Robinson: An introduction to ordinary differential equations, Cambridge University Press, Cambridge, 2004.
6. R. E. Williamson, H. F. Trotter: Multivariable mathematics, Prentice Hall (Pearson), Upper Saddle River, 2004.
7. B. S. Thomson, J. B. Bruckner, A. M. Bruckner: Elementary real analysis, Prentice Hall (Pearson), Lexington, 2008.

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 582

A	B	C	D	E	FX
11.0	12.71	16.67	21.31	32.82	5.5

Provides: RNDr. Jaroslav Šupina, PhD., RNDr. Jana Borzová, PhD.

Date of last modification: 15.04.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/FUN1/21	**Course name:** Functional programming

Course type, scope and the method:
Course type: Practice
Recommended course-load (hours):
Per week: 3 **Per study period:** 42
Course method: present

Number of ECTS credits: 3

Recommended semester/trimester of the course: 5.

Course level: I.

Prerequisities:

Conditions for course completion:
Evaluation of active participation in exercises and evaluation of homeworks. Work on a semester project.

Learning outcomes:
To learn bases of declarative programming (as complementary method to procedural programming) and basic methods of implementations of functional programming language Haskell.

Brief outline of the course:
1. Introduction to functional programming
2. Types, types of types, type variables
3. Syntax and the most important specifics of the Haskell language
4. Recursion
5. Lists
6. Data analysis 1.
7. Data analysis 2.
8. Data analysis 3.
9. Graphic outputs
10. Functions of higher ranks
11. Creating your own types
12. Monads

Recommended literature:
ABELSON, H. a G. J. SUSSMAN. Structure and interpretation of computer programs. Cambridge: MIT Press, 2002. ISBN 0-262-01153-0.
LIPOVAČA, Miran. Learn you a haskell for great good!: a beginner's guide. San Francisco: No Starch Press, 2011. ISBN 978-1-59327-283-8.
O´SULLIVAN, Bryan, Don STEWART a John GOERZEN. Real world Haskell. Beijing: O´Reilly, 2008. ISBN 978-0-596-51498-3.

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 104

A	B	C	D	E	FX
45.19	12.5	16.35	14.42	11.54	0.0

Provides: doc. RNDr. Ondrej Krídlo, PhD.

Date of last modification: 23.11.2021

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ ANO/15	**Course name:** Image analysis

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: 4

Recommended semester/trimester of the course: 5.

Course level: I., II.

Prerequisities:

Conditions for course completion:
Rules of the final examination: two parts of the final exam - theoretical oral exam and disscussion on the practical assignment.
Rules to pass the subject: Get at least 50% from both parts of the final exam. The grade will be calculated based on the result from the final exam and assignments during semester.

Learning outcomes:
To examine selected computer vision methods. To get an ability to implement chosen solutions and evaluate them on practical problems.

Brief outline of the course:
1. Introduction to computer vision.
2. Color, grayscale, binary image. Thresholding, histogram, histogram equalisation. Mathematical morphology.
3. Noise, noise removal. Filtering, convolution.
4. Frequency domain filtering, Fourier transformation, convolution theorem, sinusoid, sampling, aliasing. Method of least squares, RANSAC. Hough transform for line and circle detection.
5. Edge detection, gradient, Laplacian, Canny edge detector, corner detection.
6. Image segmentation. Clustering (k-means, meanshift). Grabcut. Active contour method. Textures.
7. Features. Blob detection. SIFT detector and descriptor. Geometric transformations.
8. Recognition. Machine learning and neural networks in computer vision. Image preprocessing, image whitening, data augmentation. Face detection, Haar features.
9. Object tracking in image sequences, mixture of Gaussians, template matching, tracking.
10. Image formation - pinhole camera. Projection from 3D to 2D, external and internal matrix, camera calibration, epipolar geometry, depth of image.

Recommended literature:
1. SZELISKI, Richard. Computer Vision: Algorithms and Applications. London: Springer, 2010. Texts in computer science. ISBN 978-1-84882-934-3.
2. ŠONKA, MIlan, HLAVÁČ, Václav a Roger BOYLE: Image Processing, Analysis, and Machine Vision. Cengage Learning, 2014. ISBN 978-1-133-59360-7.

3. ŠONKA, Milan a Václav HLAVÁČ. Počítačové vidění: první česká kniha o zpracování digitalizovaných obrazů ; rozpoznávání objektů v obrazech ; analýza trojrozměrných a pohybujících se objektů ; příklady aplikací počítačového vidění. Praha: Grada, 1992. Nestůjte za dveřmi (Grada).
4. ŠIKUDOVÁ, Elena. Počítačové videnie: detekcia a rozpoznávanie objektov. Praha: Wikina, [2014]. ISBN 978-80-87925-06-5.
5. NAYAR, Shree. First Principles of Computer Vision. [online: https://fpcv.cs.columbia.edu/]

Course language:
Slovak, English.

Notes:

Course assessment
Total number of assessed students: 71

A	B	C	D	E	FX
49.3	15.49	14.08	8.45	12.68	0.0

Provides: RNDr. Miroslav Opiela, PhD.

Date of last modification: 24.05.2024

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ ZIV/24	**Course name:** Internet of Things

Course type, scope and the method:
Course type: Practice
Recommended course-load (hours):
Per week: Per study period: 5d
Course method: present

Number of ECTS credits: 3

Recommended semester/trimester of the course: 3., 5.

Course level: I.

Prerequisities: ÚINF/PAZ1a/15

Conditions for course completion:
Design, implementation, and documentation of the final project.

Learning outcomes:
To get an overview in the field of Internet of Things and to understand basic concepts. To get an ability to design and implement particular IoT solutions (connecting sensors and actuators to microcontrollers, inter-device communication, data processing and cloud services).

Brief outline of the course:
1. Introduction to IoT, revisiting high school physics curriculum on direct current, voltage dividers. Arduino, programming in Arduino IDE, sensors and actuators, connection of basic components (button, LED, potentiometer, photoresistor).
2. Serial communication, UART, interactive connection of turtle graphics (Java) with sensors and actuators (Arduino). Digital synchronous and asynchronous communication, SPI, I2C protocol, 7-segment display, I2C expander, buzzer and melody creation. Sensor data, overview of sensor modules, sensors in smartphones, filtering of measured data.
3. Application protocols (MQTT, CoAP), overview of protocols used in IoT. Node-RED, processing of open data, IoT dashboard, connection with Arduino. Overview of other selected aspects of IoT solutions - Raspberry Pi. Cloud computing.
4. Overview of existing solutions in selected areas of IoT. Case study analysis. Design and implementation of solution prototypes based on real-world problems.
5. Design and development of the final project. Consultations on the project and final defense.

Recommended literature:
1. SELECKÝ, Matúš. Arduino: uživatelská příručka. Přeložil Martin HERODEK. Brno: Computer Press, 2016. ISBN 9788025148402.
2. UPTON, Eben a Gareth HALFACREE. Raspberry Pi: uživatelská příručka. 2., aktualizované vydání. Přeložil Jakub GONER. Brno: Computer Press, 2016. ISBN 9788025148198.
3. MONK, Simon. Programming Arduino, 2. vyd, McGraw-Hill, 2016. ISBN 9781259641633
4. Official websites and documentation for individual technologies (Arduino, MQTT, Node-RED, etc.).

Course language:

Slovak and English

Notes:

Course assessment
Total number of assessed students: 28

A	B	C	D	E	FX
67.86	7.14	10.71	14.29	0.0	0.0

Provides: RNDr. Miroslav Opiela, PhD., RNDr. Viktor Pristaš

Date of last modification: 14.05.2024

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: Dek. PF UPJŠ/USPV/13	**Course name:** Introduction to Study of Sciences
Course type, scope and the method: **Course type:** Lecture / Practice **Recommended course-load (hours):** **Per week: Per study period:** 12s / 3d **Course method:** present	
Number of ECTS credits: 2	
Recommended semester/trimester of the course: 1.	
Course level: I.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 2369

abs	n
90.12	9.88

Provides: doc. RNDr. Marián Kireš, PhD.
Date of last modification: 30.08.2022
Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/ UKN/24	**Course name:** Introduction to cognitive and neural sciences

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: 5

Recommended semester/trimester of the course: 3., 5.

Course level: I., N

Prerequisities:

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

Learning outcomes:
Overview anatomy, physiology, and cognitive processes in the human brain with focus on computational aspects of cognition and computational tools used in neuroscience.

Brief outline of the course:
1. Intro to neural and cognitive science
2. Overview of anatomy and physiology of the central nervous system (CNS)
3. Methods of study in neuroscience. Sensory, motor and associative brain areas.
4. Neuron: anatomy, types, action potential
5. Propagation of signals in the neuron, neural coding.
6. Synaptic transmission and plasticity - neural basis of learning and memory.
7. Psychology of memory and learning.
8. Vision: Intro. Perception of brightness, edges, color. Model BCS/FCS. Perception of size and sitance.
9. Hearing and auditory cognition.
10. Language, psycholinguistics, speech perception and production.
11. Attention.
12. Crossmodal interaction (vision, hearing, touch).
13. Reasoning and decision making.

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

Course language:

Slovak or English

Notes:
Content prerequisites:
Algebra, programming (Matlab).

Course assessment
Total number of assessed students: 9

A	B	C	D	E	FX
44.44	0.0	11.11	0.0	44.44	0.0

Provides: doc. Ing. Norbert Kopčo, PhD., univerzitný profesor, Ing. Peter Lokša, PhD., RNDr. Keerthi Kumar Doreswamy, PhD., Ing. Udbhav Singhal, Myroslav Fedorenko

Date of last modification: 19.03.2024

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/ UGR1/15	**Course name:** Introduction to computer graphics

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: 5

Recommended semester/trimester of the course: 3., 5.

Course level: I., II.

Prerequisities:

Conditions for course completion:

Learning outcomes:
To provide the students with knowledge of graphics algorithms and basic principles of computer graphics.

Brief outline of the course:
Graphics hardware, input and output devices. Color models, palettes. Raster graphics algorithms for drawing 2D primitives. Filling and clipping. Curve modeling, interpolations and approximations, spline forms, Bézier curves, B-splines, surfaces. Homogenous coordinates, affine transformations, perspective and parallel projections. Visible-surface determination, illumination and shading. Rendering techniques, photorealism, textures, ray tracing, radiosity. Object representations, computer animation, virtual reality.

Recommended literature:
FOLEY, J. D., van DAM, A., FEINER, S., HUGHES, J.: Computer Graphics: Principles and Practice, Addison-Wesley, 1991
MORTENSON, M.E.: Geometric modeling, 2.ed., Willey, 1997

Course language:

Notes:

Course assessment
Total number of assessed students: 326

A	B	C	D	E	FX
12.58	10.12	13.8	23.62	32.21	7.67

Provides: RNDr. Rastislav Krivoš-Belluš, PhD., doc. RNDr. Jozef Jirásek, PhD.

Date of last modification: 08.01.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ UAD/10	**Course name:** Introduction to data analysis
Course type, scope and the method: **Course type:** Lecture / Practice **Recommended course-load (hours):** **Per week:** 1 / 1 **Per study period:** 14 / 14 **Course method:** present	
Number of ECTS credits: 2	
Recommended semester/trimester of the course: 1.	
Course level: I.	
Prerequisities:	
Conditions for course completion: Test (40p) and individual project work (20p). Oral presentation of the individual project work (5p). At least 50% must be obtained from each part. Final evaluation: ≥90% A; ≥80% B; ≥70% C; ≥60% D; ≥50% E; <50% FX.	
Learning outcomes: To know the basic purpose of statistical data analysis, its methods and statistical thinking and understand its importance for science and practical life. To understand elementary statistical concepts. To gain experience in handling real data using spreadsheet Excel and statistical software R.	
Brief outline of the course: 1. Introduction (the basic philosophy and aim of statistical data analysis, descriptive and inductive statistics) 2. Collecting Data (types of data, random sample, randomized experiment) 3. Handling Data (visualization, summarizing – measures of center, measures of variability, skewness and kurtosis, empirical rule) - 5 weeks 4. Relationships in data (introduction to regression and correlation) - 4 weeks 5. Statistical inference (elementary view into estimation and testing hypothesis) - 2 weeks	
Recommended literature: 1. Rossman, A.J. et al.: Workshop Statistics: Discovery with Data, 4th ed. Wiley, 2011 2. Utts, J.M.: Seeing Through Statistics, 5th ed., Cengage Learning, 2024 3. Utts, J.M., Heckard R.F.: Mind on Statistics, 6th ed.. Cengage Learning, 2021 4. Anděl, J.: Statistické metody, Matfyzpress, 5. vydanie, Praha, 2019 (in Czech)	
Course language: Slovak	
Notes:	

Course assessment
Total number of assessed students: 520

A	B	C	D	E	FX
38.08	23.08	23.46	10.96	0.96	3.46

Provides: doc. RNDr. Martina Hančová, PhD., RNDr. Andrej Gajdoš, PhD., Mgr. Patrik Štein

Date of last modification: 21.11.2024

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ UIB1/21	**Course name:** Introduction to information security
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: 5	
Recommended semester/trimester of the course: 3.	
Course level: I.	
Prerequisities:	
Conditions for course completion: The condition for passing the course is: 1. Exercise tasks (20% of the total number of points), 2. Homeworks (30% of the total number of points), 3. Written final theoretical exam (25% of the total number of points), 4. Written final practical exam (25% of the total number of points).	
Learning outcomes: The result of the education is an understanding of the basic concepts of information security from the technical, legal and procedural views of point.	
Brief outline of the course: 1. Introduction to information security and information security model, 2. Information security management, 3. Risk and risk management, 4. Legal, normative and ethical aspects of information security, 5. Continuity management of activities, processes and security incidents handling, 6. Introduction to cryptology, 7. Access control, 8. Physical and environmental security, 9. Human resources security and social engineering, 10. End point security and malicious code, 11. Computer network security, 12. Application security, 13. Final exam.	
Recommended literature: 1. MARTIN, Andrew, Awais RASHID, Steve SCHNEIDER a Howard CHIVERS. CyBOK: The Cyber Security Body of Knowledge. The National Cyber Security Centre, 2021, 2. ANDRESS, Jason, Awais RASHID, Steve SCHNEIDER a Howard CHIVERS. Foundations of Information Security: A Straightforward Introduction. 1. No Starch Press, 2019. ISBN 978-1718500044, 3. PELTIER, Thomas, Awais RASHID, Steve SCHNEIDER a Howard CHIVERS. Information Security Fundamentals. 2. Boca Raton: Auerbach Publications, 2013. ISBN 978-1138436893.	
Course language: Slovak or English	
Notes:	

Course assessment
Total number of assessed students: 180

A	B	C	D	E	FX
44.44	25.0	19.44	6.11	2.22	2.78

Provides: doc. RNDr. JUDr. Pavol Sokol, PhD. et PhD., RNDr. Eva Marková

Date of last modification: 04.01.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ USU/19	**Course name:** Introduction to machine learning

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: 5

Recommended semester/trimester of the course: 3.

Course level: I., N

Prerequisities:

Conditions for course completion:
Creating a project focused on the application of machine learning algorithms in a selected application domain. Continuous written work focused on the preparation, processing and interpretation of data using machine learning methods. Successful completion of an oral exam focused on selected machine learning methods.

Learning outcomes:
Theoretical knowledge in the area of machine learning. Basic concepts of machine learning. Basic machine learning algorithms.

Brief outline of the course:
1. Basic concepts of machine learning.
2. Basic characteristics of data, types of attributes, characteristics for individual attributes, dependence between attributes.
3. Data sources and their acquisition. Determining the target task.
4. Preparation and cleaning of data, missing values, incorrect inputs.
5. Classification tasks
6. Selected classification methods
7. Evaluation of models - true positive, false positive, true negative, false negative examples.
8. Classification accuracy indicators.
9. Cluster analysis.
10. Association rules.
11. Prediction tasks and selected prediction methods
12. Prediction accuracy indicators.

Recommended literature:
1. AGGARWAL, Charu C. Data mining: a textbook. Cham: Springer, 2015. ISBN 978-3-319-14141-1.
2. ALPAYDIN, Ethem. Introduction to machine learning. 3rd ed. Massachusetts: MIT Press, 2014. ISBN 978-0-262-02818-9.
3. RASCHKA, Sebastian, Mirjalili, Vahid. Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2, 3rd Edition, Packt Publishing Ltd., 2019. ISBN 978-1789955750.

4. WITTEN, I. H., Eibe FRANK a Mark A. HALL. Data mining: practical machine learning tools and techniques. 4th ed. Amsterdam: Morgan Kaufmann, 2017. Morgan Kaufman series in data management systems. ISBN 9780128042915.

Course language:
Slovak or English

Notes:
Content prerequisites:
Basics of programming in Python, or another alternative programming language suitable for data analysis

Course assessment
Total number of assessed students: 47

A	B	C	D	E	FX
87.23	4.26	4.26	4.26	0.0	0.0

Provides: doc. RNDr. Ľubomír Antoni, PhD.

Date of last modification: 20.09.2021

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ UNS1/15	**Course name:** Introduction to neural networks
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: 5	
Recommended semester/trimester of the course: 5.	
Course level: I., N	
Prerequisities:	
Conditions for course completion: The condition for passing the course is the realization of a project with the application of neural networks, successful completion of two written tests in the field of neural networks, their basic types, and genetic algorithms, as well as successful completion of the written and oral part of the exam.	
Learning outcomes: The result of the education is an understanding of the basic principles of neural networks and genetic algorithms. The student will gain the ability to apply the acquired knowledge in intelligent data analysis and also work with a selected tool for modeling neural networks.	
Brief outline of the course: 1. Basic concept arising from biology. Linear threshold units, polynomial threshold units, functions calculable by threshold units. 2. Perceptrons. Linear separable objects, adaptation process (learning), convergence of perceptron learning rule, higher order perceptrons. 3. Forward neural networks, hidden neurons, adaptation process (learning), backpropagation method. 4. Recurrent neural networks. Hopfield neural networks, properties, associative memory model, energy function, learning, optimization problems (business traveler problem). 5. Model of gradually created network. ART network, architecture, operations, initialization phase, recognition phase, search and adaptation phase. Use of the ART network. 6. Applications of studied models in solving practical problems. 7. Written test I. 8. Motivation to model genetic elements. Genetic algorithm. Application of genetic algorithms. 9. Genetic programming, root trees, Read's linear code. Basic stochastic optimization algorithms: blind algorithm and climbing algorithm. Forbidden search method. 10. Genetic and evolutionary programming with typing, examples of use. Grammatical evolution. 11. Special techniques of evolutionary computations. Selection mechanisms in evolutionary algorithms. 12. Use of genetic algorithms in training neural networks. Artificial life. 13. Written test II.	

Recommended literature:

1. AGGARWAL, Charu C. Neural networks and deep learning: a textbook. Cham: Springer, 2018. ISBN 978-3319944623.
2. KVASNIČKA, Vladimír. Úvod do teórie neurónových sietí. [Slovenská republika]: IRIS, 1997. ISBN 80-88778-30-1.
3. KVASNIČKA, Vladimír. Evolučné algoritmy. Bratislava: Vydavateľstvo STU, 2000. Edícia vysokoškolských učebníc. ISBN 80-227-1377-5.
4. MITCHEL, Melanie. An Introduction to Genetic Algorithms. Cambridge: MIT Press, 2002. ISBN 0-262-63185-7.
5. SINČÁK, Peter, ANDREJKOVÁ, G. Úvod do neurónových sietí, I. diel, Košice: ELFA, 1996. ISBN 808878638X

Course language:

Slovak or English

Notes:

Content prerequisites:
Basics of programming in Python, or another alternative programming language suitable for data analysis

Course assessment

Total number of assessed students: 535

A	B	C	D	E	FX
24.11	17.01	20.19	16.45	18.69	3.55

Provides: doc. RNDr. Ľubomír Antoni, PhD., RNDr. Šimon Horvát, PhD.

Date of last modification: 23.11.2021

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/ MZI/21	**Course name:** Introduction to study of informatics

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: 5

Recommended semester/trimester of the course: 1.

Course level: I.

Prerequisities:

Conditions for course completion:
Understanding of basic mathematical notions

Learning outcomes:
Understanding of basic mathematical notions

Brief outline of the course:
1. Mathematical text
2. Connections and quantifiers
3. Classes and sets
4. Other operarions operácie
5. Relations
6. Relational algebra
7. Orderings
8. Equivalences
9. Functions
10. Cardinalities
11. Infinities
12. Cardinal arithmetics

Recommended literature:
https://ics.upjs.sk/~krajci/skola/vyucba/jesen/predmety/MZI.html

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 414

A	B	C	D	E	FX
38.16	20.29	13.04	3.86	1.69	22.95

Provides: prof. RNDr. Stanislav Krajči, PhD.

Date of last modification: 23.11.2021
Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/LCO/10	**Course name:** Linear and integer programming

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: 5

Recommended semester/trimester of the course: 3.

Course level: I.

Prerequisities: ÚMV/ALGa/10

Conditions for course completion:
Continuous evaluation: a small test during each tutorial, two large tests, a project with real data and commercial software. Bonus points awarded for homeworks (formulation of proofs). A necessary condition for final exam is at least 50% of points from th semester. Final exam: demonstrate the understanding of the theory and ability of argumentation.

Learning outcomes:
Ability to formulate practical tasks in a form of a linear program. Proficiency in solving linear programs by several methods, also using software. Understanding of the underlying theory and ability of exact argumentation.

Brief outline of the course:
Formulation of linear and integer programs. Geometric solution. Simplex method, its correctness an finiteness. Duality and its economic interpretation. Dual and revised simplex method. Sensitivity analysis and parametric programming. Algorithms for integer programming: branch and bound, Gomory cuts. Computational complexity of LP and ILP. Solution of practical problems.

Recommended literature:
lms.upjs.sk - podklady k prednáškam a zadania úloh na cvičenia.
Plesník, Dupačová, Vlach: Lineárne programovanie, Alfa, Bratislava 1990
Ch. Papadimitriou – K. Steiglitz: Combinatorial Optimization: Algorithms and Complexity, 1984
R.J. Vanderbei, Linear Programming:Foundations and Extentions, Springer 2020, electronic version: http://www.princeton.edu/~rvdb/LPbook/

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 177

A	B	C	D	E	FX
21.47	18.08	19.21	20.34	18.08	2.82

Provides: prof. RNDr. Katarína Cechlárová, DrSc., Mgr. Juraj Hirjak
Date of last modification: 17.04.2022
Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/ZLI/21	**Course name:** Linux basics

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: I., N

Prerequisities:

Conditions for course completion:
The condition for passing the course is: 1. Homeworks (50% of the total number of points), 2. Written final theoretical exam (25% of the total number of points), 3. Written final practical exam (25% of the total number of points).

Learning outcomes:
The result of the education is an understanding of the theoretical and practical background for studying computer science, by giving the necessary knowledge in the usage of Unix/Linux operating systems.

Brief outline of the course:
1. Introduction to Unix/Linux systems, 2. Linux ommand line, 3. Text processing tools, 4. Managing files, 5. Managing users, groups and rights, 6. Managing processes, 7. Managing software and packages, 8. Administering the system - system booting, jobs, logging,9. Basic networking, 10. Managing network interfaces, 11. Managing disk partitions, 12. Exam.

Recommended literature:
1. LPIC-1 Exam 101. LPI [online]. Canada: The Linux Professional Institute, 2021 [cit. 2021-9-22]. Dostupné z: https://learning.lpi.org/en/learning-materials/101-500/, 2. LPIC-1 Exam 102. LPI [online]. Canada: The Linux Professional Institute, 2021 [cit. 2021-9-22]. Dostupné z: https://learning.lpi.org/en/learning-materials/102-500/, 3. Linux - Dokumentační projekt [online]. 4. Praha: Computer Press, 2007 [cit. 2021-9-22]. Dostupné z: https://i.iinfo.cz/files/root/k/LDP_4.pdf.

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 240

A	B	C	D	E	FX
41.25	21.67	18.75	6.25	5.83	6.25

Provides: doc. RNDr. JUDr. Pavol Sokol, PhD. et PhD., RNDr. Eva Marková, RNDr. Richard Staňa
Date of last modification: 04.01.2022
Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ LOP1/15	**Course name:** Logic programming
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: 5	
Recommended semester/trimester of the course: 4.	
Course level: I., II.	
Prerequisities:	
Conditions for course completion: Evaluation of active participation in exercises and homework, test of theoretical knowledge during the semester. Written and oral exam together with assessment from exercises.	
Learning outcomes: To learn bases of declarative programming (as complementary method to procedural programming) and basic methods of implementations of logic programming languages.	
Brief outline of the course: 1. Introduction to logic 2. theory, models, Herbrand model 3. SLD resolution 4. Basics of Prolog language 5. Prologue in examples 6. Lists 7., 8., 9. Data analysis in Prolog 10., 11., 12. Graph theory in Prolog	
Recommended literature: BRATKO, Ivan. Prolog. Programming for Artificial Intelligence. 2 ed. Wokingham: Addison-Wesley, 1990. ISBN 0-201-41606-9. NILSON U., MALUSINSKI J.: Logic, Programming and Prolog, John Wiley & Sons Ltd. 1995 NIENHUYIS-CHENG Sh.H., WOLF R.: Foundations of Inductive Logic Programming, Springer-Verlag, 1997	
Course language: Slovak or English	
Notes: Prerequisites: none	

Course assessment
Total number of assessed students: 339

A	B	C	D	E	FX
24.48	13.27	16.52	22.42	21.83	1.47

Provides: doc. RNDr. Ondrej Krídlo, PhD.

Date of last modification: 23.11.2021

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ MIS/15	**Course name:** Management of information systems

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

Number of ECTS credits: 4

Recommended semester/trimester of the course: 4.

Course level: I.

Prerequisities:

Conditions for course completion:
Completion of the subject is conditional on the completion of partial tasks within the group project during the semester in an appropriate quality. The project is aimed at:
- mastering the basic concepts and methods taught,
- mastering the principles of related IT tools,
- presentation and defense of the created project.

Detailed conditions for evaluating partial tasks and obtaining a final evaluation are published in the AIS.

Learning outcomes:
By completing the subject, students will gain
- knowledge of the general aspects of the design and use of information systems for managing the organisation in relation to the strategic goals of the organisation,
- knowledge of the principles of basic ICT technologies used to manage processes in various areas of the company's functioning,
- basic knowledge and skills on the use of relevant IT tools,
- experience of working in a heterogeneous team and with project presentation.

Brief outline of the course:
1. Introduction to information systems.
2. Organisational strategy and the role of information systems in gaining competitive advantage.
3. Managing data and knowledge.
4. Business Intelligence.
5. Ethics and privacy protection.
6. Information security.
7. Social computing
8. Electronic commerce.
9. Wireless and mobile computing.
10. The role of information systems within the organisation and public administration.
11. CRM systems.
12. Management of supply-customer chains.
13: Procurement and implementation of information systems.

Recommended literature:

1. R. Kelly Rainer, Brad Prince, Hugh J. Watson, Management Information Systems, Wiley 2015, ISBN : 978-1-118-89538-2
2. Voříšek, J.: Strategické řízení informačního systému a systémová integrace, Praha, Management Press, 1999.
3. O'Brien, J., Marakas, G.: Management Information Systems, McGraw-Hill, 2010, ISBN 0073376813.
4. Laudon, K., Traver, C.G.: Management Information Systems: Managing the Digital Firm, Prentice Hall, 2011, ISBN 0132142856.

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 52

A	B	C	D	E	FX
42.31	26.92	13.46	11.54	3.85	1.92

Provides: prof. RNDr. Gabriel Semanišin, PhD., Ing. Štefan Puci

Date of last modification: 25.07.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ MMD/22	**Course name:** Mathematical modeling

Course type, scope and the method:
Course type: Practice
Recommended course-load (hours):
Per week: 3 **Per study period:** 42
Course method: present

Number of ECTS credits: 3

Recommended semester/trimester of the course: 1., 3.

Course level: I.

Prerequisities:

Conditions for course completion:
Submitting a project from the specified list of projects and, possibly, a related short presentation.

Learning outcomes:
Using concrete examples of problems from real life, students will become familiar with several approaches and strategies for creating a mathematical model of specified problem as well as with defining the conditions related a real problem and transforming them into created mathematical model.

Brief outline of the course:
One specified real-life problem will be discussed, explored and modeled each week.

Recommended literature:
1. E. Lindner, A. Micheletti, C. Nunes (eds.), Mathematical Modelling in Real Life Problems, Springer, 2020.
2. K.K. Tung, Topics in Mathematical Modeling, Princeton University Press, 2007.
3. H. P. Williams, Model Building in Mathematical Programming, Wiley, 2013.

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 41

A	B	C	D	E	FX
78.05	17.07	4.88	0.0	0.0	0.0

Provides: RNDr. Jana Borzová, PhD., prof. RNDr. Katarína Cechlárová, DrSc., RNDr. Igor Fabrici, Dr. rer. nat., RNDr. Andrej Gajdoš, PhD., RNDr. Lenka Halčinová, PhD., RNDr. Jaroslav Šupina, PhD., doc. RNDr. Martina Hančová, PhD., Mgr. Martin Vodička, Dr. rer. nat., prof. RNDr. Ondrej Hutník, PhD., prof. RNDr. Ivan Žežula, CSc., RNDr. Lucia Kőszegyová, PhD., doc. Mgr. Jozef Kiseľák, PhD., doc. RNDr. Daniel Klein, PhD., prof. RNDr. Tomáš Madaras, PhD.

Date of last modification: 25.08.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ MSW/10	**Course name:** Mathematical software

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

Number of ECTS credits: 3

Recommended semester/trimester of the course: 2.

Course level: I.

Prerequisities:

Conditions for course completion:
Master the basics of working with a spreadsheet calculator, working in the R programming language and the Maple computer algebra system. Demonstrate the ability to use these tools to solve problems in different areas of mathematics.
Points are given for two semester tests and homework assignments: A test on solving problems in a spreadsheet environment (20 points) and a test on solving problems using R and Maple (20 points), homework assignments focusing on solving exercises using R and Maple (10 points).
The grade is awarded according to the number of points obtained: A - 45 or more, B - 40 to 44, C - 35 to 39, D - 30 to 34, E - 25 to 29, Fx - less than 25.

Learning outcomes:
Knowledge and skills of using different representations of data and modeling in solving different types of mathematical problems in the environment of a spreadsheet, R language and the system of symbolic calculations Maple. Be able to analyze data when working with tables, create different types of graphs, use different types of functions implemented in a spreadsheet and mathematical methods to solve problems.

Brief outline of the course:
1. Creation and use of formulas, creation and modification of graphs.
2. Use of different types of functions implemented in a spreadsheet, problems from financial mathematics.
3. Statistical data processing, creation of stochastic models, Monte Carlo method.
4. Implementation of algorithms in tables, graphical and numerical solution of equations and systems of linear equations.
5, Linear optimization, test
Basic description of Maple system and R language, work with matrices and vectors, work with data and data files. Basic programming techniques, creating your own functions and scripts, graphical capabilities of the system for data visualization. Modification of mathematical expressions, solution of equations and inequalities, mathematical analysis, linear algebra, theory of numbers, graphs and sets in the Maple system.

Recommended literature:

1. Shingareva, Lizárraga-Celaya: Maple and Mathematica. A problem solving approach for mathematics, Springer Wien NewYork, 2007
2. Eberhart: Maple problem solving handbook, University of Kentucky, 2009
3. Šťastný: Matematické a statistické výpočty v Microsoft Excelu, Computer Press 2001

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 208

A	B	C	D	E	FX
25.48	20.19	23.08	19.23	9.13	2.88

Provides: doc. RNDr. Stanislav Lukáč, PhD., RNDr. Alfréd Onderko, PhD., RNDr. Katarína Brinziková

Date of last modification: 06.02.2025

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ MST/19	**Course name:** Mathematical statistics

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: 5

Recommended semester/trimester of the course: 5.

Course level: I., II.

Prerequisities:

Conditions for course completion:
Total evaluation based on two written tests during the semester (2x40p) and the result of the written (30p) and oral part of the exam (30p).
At least 50% must be obtained from each part.
Final evaluation: ≥90% A; ≥80% B; ≥70% C; ≥60% D; ≥50% E; <50% FX.

Learning outcomes:
Student should obtain the knowledge about basic statistical methods and the ability to apply theoretical knowledge in practical problems solving.

Brief outline of the course:
1. Random vectors (definition, distributions, characteristics, joint and marginal distributions).
2. Covariance, correlation and regression.
3. Random sample, sampling distributions and characteristics.
4. Some important statistics and their distributions.
5. Point estimators and their properties.
6. Maximum likelihood method.
7. Interval estimates, confidence interval construction (2 weeks).
8. Testing of statistical hypothesis (critical region, level of significance and power of test, methods for searching optimal critical regions).
9. Some important parametric tests (2 weeks).
10. Some important nonparametric tests (2 weeks).

Recommended literature:
1. Skřivánková V.: Pravdepodobnosť v príkladoch, UPJŠ, Košice, 2006 (in Slovak)
2. Skřivánková V.-Hančová M.: Štatistika v príkladoch, UPJŠ, Košice, 2005 (in Slovak)
3. Casella, G., Berger, R., Statistical Inference, 2nd ed., Chapman and Hall/CRC, 2024
4. DeGroot, M. H., Schervish, M. J.: Probability and Statistics, 4th ed., Pearson, Boston, 2012
5. Anděl J.: Základy matematické statistiky, MatfyzPress, Praha, 2011 (in Czech)

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 200

A	B	C	D	E	FX
25.5	21.0	16.5	18.5	10.5	8.0

Provides: doc. RNDr. Martina Hančová, PhD.

Date of last modification: 21.11.2024

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ MAP/19	**Course name:** Matrix calculus

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: 5

Recommended semester/trimester of the course: 3.

Course level: I.

Prerequisities: ÚMV/ALG1b/24 or ÚMV/ALG3b/22

Conditions for course completion:
Exam

Learning outcomes:
Mastering basic knowledge on matrices, their properties, different matrix decompositions, and special matrices.

Brief outline of the course:
1. Basic concepts of linear algebra, geometry of vector spaces
2. Basic concepts of matrix algebra, special matrices, matrix operations, vectorization of matrices
3. Column space and null space of a matrix, rank of a matrix
4. Inverse matrices, orthogonal and permutation matrices
5. Matrix space and its geometry
6. Generalized inverse matrices
7. Idempotent matrices and projection matrices
8. Determinant of a matrix
9. Positive semidefinite and positive definite matrices
10. Eigenvalues and eigenvectors of matrices
11. Singular decomposition and matrix norms

Recommended literature:
1. Rosa, S., Harman, R.: Maticová algebra pre štatistiku a analýzu dát, FMFI UK, 2021.
2. Strang, G.: Linear Algebra and Learning from Data, Wellesley- Cambridge Press, 2019.
3. Seber, G.A.F.: A matrix handbook for statisticians. John Wiley & Sons, 2008
4. Searle, S.R., Khuri, A.I.: Matrix algebra useful for statistics. John Wiley & Sons, 2017.
5. Meyer, C.D.: Matrix Analysis and applied linear algebra. SIAM, 2000

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 25

A	B	C	D	E	FX
28.0	12.0	16.0	16.0	24.0	4.0

Provides: prof. RNDr. Ivan Žežula, CSc., doc. RNDr. Daniel Klein, PhD.

Date of last modification: 14.04.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/BSA/22	**Course name:** Methods of data analysis and artificial intelligence

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: I.

Prerequisities: ÚMV/FRPb/19 and ÚMV/LCO/10 and ÚMV/MST/19 and ÚINF/USU/19 and ÚINF/UNS1/15

Conditions for course completion:
Knowledge and competencies from the profile subjects of the study program, demonstrating the ability to synthesize the acquired knowledge and procedures, and applying them to the problems of data analysis and artificial intelligence.

Learning outcomes:
Evaluation of student‘s competences with respect to the profile of the graduate.

Brief outline of the course:
The state examination is performed in a form of a debate with the emphasis on one topic of the following courses:ÚMV/FRPb/19, ÚMV/LCO/10, ÚMV/MST/19, ÚINF/USU/19 and ÚINF/UNS1/15.
1. Differential calculus, integral calculus and their applications.
2. Linear programming problems, solution methods and complexity, duality in linear programming and its interpretation.
3. Random variables, their distributions and characteristics, estimation theory and statistical hypotheses testing.
4. Basic principles of machine learning and its methods.
5. Basic principles of neural networks and their methods.

Recommended literature:

Course language:
slovak

Notes:

Course assessment
Total number of assessed students: 11

A	B	C	D	E	FX
36.36	36.36	27.27	0.0	0.0	0.0

Provides:

Date of last modification: 25.04.2025
Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ NUM/19	**Course name:** Numerical methods

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: 2 / 3 **Per study period:** 28 / 42
Course method: present

Number of ECTS credits: 6

Recommended semester/trimester of the course: 6.

Course level: I.

Prerequisities: (ÚMV/MANb/19 or ÚMV/MAN2b/22 or ÚMV/FRPb/19) and (ÚMV/ALG1b/24 or ÚMV/ALG2b/22 or ÚMV/ALG3b/22 or ÚMV/ALG4b/22)

Conditions for course completion:
Form: Lectures and practices using computers. Solving problems and programming algorithms using the computational platform SageMath (including Python, NumPy, SciPy, SymPy, R, Maxima, matplotlib, GAP, FLINT, and many other packages).
Interim assessment (50% of the total assessment): Solving assigned tasks e.g. in the form of implementation of algorithms or their parts, modification of existing codes or use of available packages in solving real problems.
Final examination (50% of the total assessment): It consists of verifying the understanding of the theory taken over and demonstrating the practical skills acquired.

Learning outcomes:
After completing the course, the student will acquire theoretical knowledge and practical skills regarding the principles and implementation of basic numerical algorithms with emphasis on algorithms used in the field of data analysis.
The student should be able to understand and implement numerical algorithms in programming language independently, to be able to modify components of existing algorithms
and also be able to solve (real) problems by selecting an appropriate numerical method with the available effective computational packages.

Brief outline of the course:
1. Basic principles and techniques of numerical analysis - computer implementation and representation of real numbers, numerical vs. symbolic (analytical) calculations, method vs. algorithm, error measurement of numerical solution, conditionality of numerical problems, stability and convergence of numerical algorithms.
2. Solution of nonlinear equations - methods of bisection and simple iteration, the false position method and Newton method, Newton-Raphson method.
3. Numerical differentiation and integration - trapezoidal method, Simpson method, Newton-Cotes formulas.
4. Approximation of functions and smoothing of data, using polynomials, interpolation, splines, kernel methods.

5. Linear systems - Gaussian elimination with and without pivoting, forward and backward substitution, scaled partial pivoting, singularity and perturbation, matrix conditionality, Thomas method, iterative methods - Jacobi, Gauss-Seidel, SOR method, gradient methods - gradient descent, conjugate directions.
6. Eigenvalues and eigenvectors of matrices - estimation of eigenvalues, partial eigenvalue problem (power method and Rayleigh method, Hessenberg shape), complete eigenvalue problem (calculation of dominant eigenvalue, LU, QU, QR - decomposition, Jacobi method), SVD - Singular Matrix Decomposition.
7. Optimization - MLS, Cauchy method of the highest gradient, Newton method, conjugated gradient method of Fletcher-Reeves, Quasi-Newton methods, Regularization of ill-conditioned problems.

Recommended literature:

1. Ackleh, A. S., Allen, E. J., Kearfott, R. B., & Seshaiyer, P. (2009). Classical and Modern Numerical Analysis: Theory, Methods and Practice (1 edition). Boca Raton: Chapman and Hall/ CRC.
2. Anastassiou, G. A., & Mezei, R. (2015). Numerical Analysis Using Sage. Springer International Publishing.
3. Cheney, E. W., & Kincaid, D. R. (2012). Numerical Mathematics and Computing (7 edition). Boston, MA: Cengage Learning.
4. O'Leary, D. P. (2008). Scientific Computing with Case Studies. Philadelphia: Society for Industrial and Applied Mathematics.
5. Sauer, T. (2017). Numerical Analysis. (3 edition). Hoboken, NJ? Pearson.
6. Segethová, J. (2002). Základy numerické matematiky. Karolinum.
7. M. Vicher (2003). Numerická matematika.

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 142

A	B	C	D	E	FX
13.38	16.9	8.45	14.79	34.51	11.97

Provides: doc. Mgr. Jozef Kiseľák, PhD., RNDr. Stanislav Basarik, PhD.

Date of last modification: 18.04.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/PBS/15	**Course name:** Pro-seminar to bachelor thesis

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

Number of ECTS credits: 1

Recommended semester/trimester of the course: 4.

Course level: I.

Prerequisities:

Conditions for course completion:
Creating a website about a bachelor's thesis. Selection of bachelor thesis topic. Presentation of the bachelor's thesis assignment and its objectives. Preparation of an essay in the extent of 1 page on the motivation to select a bachelor's thesis. Creation of the bachelor's thesis assignment and its insertion into the AIS by the thesis supervisor.

Learning outcomes:
Basic knowledge of the principles of creation and structure of bachelor's theses. Criteria and requirements for selecting an appropriate bachelor thesis topic. Knowledge about the structure of the bachelor's thesis assignment.

Brief outline of the course:
1. Principles in creating a final thesis.
2. The presentations of bachelor thesis topics by potential supervisors.
3. The presentations of bachelor thesis topics by potential supervisors.
4. The presentations of bachelor thesis topics by potential supervisors.
5. Bachelor thesis and its objectives.
6. Assignment of bachelor thesis.
7. Basic types of bachelor theses.
8. Structure of different types of bachelor theses.
9. Requirements for final bachelor theses.
10. External company final theses.
11. Presentation of selected topics of final theses.
12. Presentation of selected topics of final theses.
13. Presentation of selected topics of final theses.

Recommended literature:
1. STN 01 6910. Rules of writing and editing documents. 2011.
2. STN ISO 2145. Documentation. Numbering of sections and subsections of written documents. 1997.
3. STN ISO 690. Information and documentation. Instructions for creating bibliographic references to information sources and their citation. 2012
4. KATUŠČÁK, Daniel. How to write final and qualification theses. Enigma, 2013

5. Scientific literature related to the topic of the final thesis according to the recommendation of the thesis supervisor.

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 389

abs	n
95.37	4.63

Provides: RNDr. Miroslav Opiela, PhD., RNDr. Dávid Varga

Date of last modification: 08.01.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ TPP/19	**Course name:** Probability theory

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: 5

Recommended semester/trimester of the course: 4.

Course level: I.

Prerequisities: ÚMV/MAN1c/22 or ÚMV/MAN2c/22 or ÚMV/FRPa/19

Conditions for course completion:
To obtain at least 50% in two written tests during the semester.
Total evaluation based on written tests and oral exam.

Learning outcomes:
To obtain knowledge of the axiomatic theory of probability, random variables and their characteristics, special types of distributions and their applications.

Brief outline of the course:
Probability space, definitions and properties of probability.
Conditional probability and independence.
Random variables, their distribution function and characteristics.
Mean, variance and skewness.
Discrete and absolutely continuous distributions.
Quantile and characteristic functions, their properties. Relation between characteristic function and moments. Median and mode.
Transformation of random variables.
Special types of distributions with applications (binomial, Poisson, geometric, uniform, exponential, normal, chi-square, Student, Fisher).
Central limit theorem.

Recommended literature:
1. Skřivánková V.: Pravdepodobnosť v príkladoch, UPJŠ, Košice, 2006 (in Slovak)
2. DeGroot, M. H., Schervish, M. J.: Probability and Statistics, 4th ed., Pearson, Boston, 2012
3. Evans, M. J., Rosenthal, J. S.: Probability and Statistics: The Science of Uncertainty, 2nd Ed., W. H. Freeman, 2009
4. Riečan et al.: Pravdepodobnosť a matematická štatistika, Alfa, Bratislava, 1984 (in Slovak)
5. Potocký a kol.: Zbierka úloh z pravdepodobnosti a matematickej štatistiky, Alfa, Bratislava, 1991

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 395

A	B	C	D	E	FX
14.43	14.43	17.22	21.27	26.08	6.58

Provides: doc. RNDr. Daniel Klein, PhD., RNDr. Miriam Kleinová, PhD.

Date of last modification: 27.01.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/PMO1/15	**Course name:** Proces modelling

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: 5

Recommended semester/trimester of the course: 4., 6.

Course level: I., N

Prerequisities: ÚINF/PAZ1b/15 and ÚINF/DBS1a/15 and ÚINF/SWI1a/15

Conditions for course completion:
The interim evaluation is based on the evaluation of partial tasks within the solution of the semester project.
The final assessment is given on the basis of the interim assessment and the result of the exam. On the exam, it is required to prove the ability to orient oneself in the presented issue, to master the theoretical foundations of process modeling, basic skills for the creation and interpretation of process models.
The evaluation is awarded if the student gets at least 50% of the possible points from each part of the exam. Detailed requirements are given in the AIS.

Learning outcomes:
By completing the subject, the student:
- acquires knowledge about the theoretical starting points and basics of process modeling,
- can master the basic principles of creating process models
- get familiar with standard languages for process modeling
- will gain practical experience in creating models using selected modeling tools.

Brief outline of the course:
1. Introduction to process modeling.
2. Development of approaches to the development of large software systems.
3. Theoretical foundations of process modeling.
4. Petri nets.
5. Process orchestration.
6. Choreography of processes.
7. Selected properties of processes and process models.
8. Architectures of process models.
9. Methodologies and standards.

Recommended literature:
1. Ehrig, H.; Juhas, G.; Padberg, J.; Rozenberg, G. (Eds.), Advances in Petri Nets, Lecture Notes in Computer Science , Vol. 2128 (2001)

2. Eshuis, R. ; Wieringa R.: Comparing Petri Net and Activity Diagram Variants for Workflow Modelling – A Quest for Reactive Petri Nets, [dostupné online http://is.tm.tue.nl/staff/heshuis/pnt.pdf]
3. Madison D., Process Mapping, Process Improvement and Process Management, Paton Press 2005
4. Weske, M. Business Process Management, Springer 2007
5. White S.A., Miers D., Fischer L., BPMN Modeling and Reference Guide, Future Strategies Inc., Lighthouse Pt 2008
6. White:, S.A. Process Modeling Notations and Workflow Patterns, [available online http://www.omg.org/bp-corner/bp-files/Process_Modeling_Notations.pdf]

Course language:
Slovak or English

Notes:
Content prerequisities: programming, bases of software engineering and database management systems, bases of project management

Course assessment
Total number of assessed students: 59

A	B	C	D	E	FX
15.25	22.03	27.12	20.34	8.47	6.78

Provides: prof. RNDr. Gabriel Semanišin, PhD.

Date of last modification: 25.07.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/PAZ1a/15	**Course name:** Programming, algorithms, and complexity

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: 3 / 4 **Per study period:** 42 / 56
Course method: present

Number of ECTS credits: 8

Recommended semester/trimester of the course: 1.

Course level: I.

Prerequisities:

Conditions for course completion:
Graded activities during semester: assignments, small exams, midterm, final project.
Final examination: practical finalterm focused on a complex task.
Rules to pass the subject: Pass the minimal limit of points for category of homeworks (assignments, final project) and tests (small exams, midterm). Get at least 42% from the finalterm and pass the defined limit of total points for all graded activities.

Learning outcomes:
Get an ability to implement basic Java programs and obtain essential knowledge related to object-oriented programming.

Brief outline of the course:
1. Introduction to Java and JPAZ2 framework, first Eclipse project, interactive communication with objects using turtle graphics, repeating code in loops, notion of class, object, and method.
2. For-loops, local variables, variable types, arithmetic expressions, random numbers, random walk, conditions.
3. While-loop, returning a value from a method, reference and reference variables, debugging.
4. Primitive and reference types, chars, String objects (including basic algorithms), mouse events, instance variables.
5. Array of primitive values and array of references, simple array algorithms.
6. Advanced array algorithms, two-dimensional array.
7. Exceptions and exception handling, files and directories, writing to text files.
8. Reading from text files.
9. Creating classes, encapsulation, getters and setters, constructors and their hierarchy, method overloading.
10. Inheritance and polymorphism.
11. Java Collections Framework, ArrayList class, wrapper classes for primitive types and autoboxing, interfaces List, Set, Map and their implementations, methods equals and hashCode.
12. Access modifiers, abstract classes and methods, creating and implementing interfaces, sorting, static methods and variables.
13. Creating and throwing exceptions, checked and runtime exceptions, JavaDoc, Maven.

Recommended literature:

1. ECKEL, Bruce. Thinking in Java. Fourth edition. Upper Saddle River, NJ: Prentice Hall, c[2006]. ISBN 978-01-318-7248-6.
2. PECINOVSKÝ, Rudolf. OOP: naučte se myslet a programovat objektově. Brno: Computer Press, 2010. ISBN 978-80-251-2126-9.
3. SIERRA, Kathy a Bert BATES. Head first Java. Vyd. 2. Sebastopol: O´Reilly, 2005. ISBN 978-05-960-0920-5.

Course language:
Slovak language, english language is required only to read Java API documentation.

Notes:

Course assessment
Total number of assessed students: 961

A	B	C	D	E	FX
16.86	8.64	12.28	18.73	13.94	29.55

Provides: RNDr. Juraj Šebej, PhD., RNDr. Miroslav Opiela, PhD., RNDr. Viktor Pristaš, doc. RNDr. Ondrej Krídlo, PhD., RNDr. Richard Staňa, Mgr. Viktor Olejár, Mgr. Dominika Kotlárová

Date of last modification: 04.01.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ PAZ1b/15	**Course name:** Programming, algorithms, and complexity

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: 2 / 4 **Per study period:** 28 / 56
Course method: present

Number of ECTS credits: 7

Recommended semester/trimester of the course: 2.

Course level: I.

Prerequisities: ÚINF/PAZ1a/15

Conditions for course completion:
Graded activities during semester: assignments, small theoretical exams, practical and theoretical midterm.
Final examination: practical and theoretical finalterm.
Rules to pass the subject: Get at least 50% from theoretical activities (small exams, theoretical midterm and theoretical finalterm) and from practical activities (practical midterm and finalterm). Pass the defined limit of total points for all graded activities.

Learning outcomes:
To know essential algorithms, data structures, and methods used for efficient algorithms design. To understand time complexity analysis. To practice efficient implementation of algorithms. To recognize combinatorial and graph algorithms.

Brief outline of the course:
1. Recursion and fractals.
2. Binary search, basic sorting algorithms, time complexity analysis, O-notation.
3. Basic data structures and algorithms: linked list, stack, queue.
4. Trees and their applications.
5. Efficient sorting algorithms (QuickSort, MergeSort, HeapSort).
6. Backtracking.
7. Dynamic programming, divide and conquer strategy.
8. Unweighted graphs, graph traversal, graph topological sort.
9. Weighted graphs, the shortest path algorithms.
10. Minimum spanning tree, greedy algorithms.
11. Hashing, amortized time complexity, string-searching algorithms.

Recommended literature:
1. WRÓBLEWSKI, Piotr. Algoritmy: datové struktury a programovací techniky. Brno: Computer Press, 2004. ISBN 80-251-0343-9.
2. CORMEN, Thomas H. Introduction to algorithms. 3rd ed. Cambridge: MIT Press, c2009. ISBN 978-0-262-03384-8.
3. KLEINBERG, Jon a Éva TARDOS. Algorithm design. Thirteenth impression. Noida, India: Pearson, c2014. ISBN 9789332518643.

4. MAREŠ, Martin a Tomáš VALLA. Průvodce labyrintem algoritmů. Praha: CZ.NIC, z.s.p.o., 2017. CZ.NIC. ISBN 978-80-88168-19-5.

Course language:
Slovak language, literature is available in english and czech language.

Notes:

Course assessment
Total number of assessed students: 1356

A	B	C	D	E	FX
14.97	7.82	10.62	18.88	20.65	27.06

Provides: RNDr. Juraj Šebej, PhD., RNDr. Miroslav Opiela, PhD., RNDr. Viktor Pristaš, doc. RNDr. Ondrej Krídlo, PhD., Mgr. Dominika Kotlárová

Date of last modification: 04.01.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ PDAb/19	**Course name:** Project of data analysis II

Course type, scope and the method:
Course type: Practice
Recommended course-load (hours):
Per week: 3 **Per study period:** 42
Course method: present

Number of ECTS credits: 3

Recommended semester/trimester of the course: 5.

Course level: I.

Prerequisities:

Conditions for course completion:
Activity at the practise session. Homeworks. Presentation of applied methods and obtained results for the considered problem.

Learning outcomes:
Become familiar with handling a complex data problem which consist of data management, data analysis, method proposal for the considered problem and its following implementation for the given data.

Brief outline of the course:
Individual work or work in groups on real applied problems. Data analysis - variables structure, classification, missing values, outliers. Suggested solutions based on classical statistical approach, solutions based on machine learning and neural networks.

Recommended literature:
James, Gareth, et al. An introduction to statistical learning. Vol. 112. New York: Springer, 2013.
Efron, Bradley, and Trevor Hastie. Computer age statistical inference. Vol. 5. Cambridge University Press, 2016.
Raschka, Sebastian, and Vahid Mirjalili. Python machine learning. Packt Publishing Ltd, 2017.
VanderPlas, Jake. Python data science handbook: essential tools for working with data. " O'Reilly Media, Inc.", 2016.
Study literature related to the suggested project.

Course language:
Slovak or english.

Notes:

Course assessment
Total number of assessed students: 20

A	B	C	D	E	FX
100.0	0.0	0.0	0.0	0.0	0.0

Provides: Mgr. Katarína Lučivjanská, PhD., doc. RNDr. Ľubomír Antoni, PhD.

Date of last modification: 26.03.2019
Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/ SZPa/22	**Course name:** Special seminar to bachelor thesis

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

Number of ECTS credits: 1

Recommended semester/trimester of the course: 5.

Course level: I.

Prerequisities:

Conditions for course completion:
Update of the bachelor thesis website. Presentation of the current state of knowledge for the topic selected in the bachelor's thesis. Presentation of the first results of bachelor thesis. Preparing of scientific article of 5 pages length in the required structure. Approval of the article by the thesis supervisor.

Learning outcomes:
Basic knowledge about the procedure and writing of the bachelor's thesis, standards and formal aspects of the bachelor's thesis, the creation of bibliographic references and their citations, tools for creating the database of used literature. Basic knowledge of the content and form of presentation of the current state of knowledge for the topic of the bachelor's thesis. Basic knowledge about the preparation of a scientific article.

Brief outline of the course:
1. Procedure for writing the bachelor thesis.
2. Standards and formal aspects of the bachelor thesis.
3. Rules of writing and editing documents STN 01 6910.
4. Documentation, Numbering of sections and subsections of written documents STN ISO 2145.
5. Information and documentation STN ISO 690.
6. Instructions for creating bibliographic references to information sources and their citation.
7. Selected typographic principles.
8. Professional resources on the Internet.
9. Principles of correct citation.
10. Tools for creating your own database of used literature.
11. Annotation of read literature, creation of searches.
12. Presentation of selected topics of bachelor theses.
13. Presentation of selected topics of bachelor theses.

Recommended literature:
1. STN 01 6910. Rules of writing and editing documents. 2011.
2. STN ISO 2145. Documentation. Numbering of sections and subsections of written documents. 1997.

3. STN ISO 690. Information and documentation. Instructions for creating bibliographic references to information sources and their citation. 2012
4. KATUŠČÁK, Dušan. How to write final and qualification theses. Enigma, 2013
5. Scientific literature related to the topic of the final thesis according to the recommendation of the thesis supervisor.

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 195

abs	n	neabs
98.97	1.03	0.0

Provides: RNDr. Miroslav Opiela, PhD., RNDr. Dávid Varga

Date of last modification: 08.01.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ SZPb/22	**Course name:** Special seminar to bachelor thesis

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

Number of ECTS credits: 1

Recommended semester/trimester of the course: 6.

Course level: I.

Prerequisities:

Conditions for course completion:
Update of the bachelor thesis website. Presentation of the obtained results of the bachelor's thesis. Preparation of at least a 10-page scientific article for the topic chosen in the bachelor's thesis in the required structure and its approval by the thesis supervisor. Creating a promotional image (poster) about the results of the bachelor's thesis.

Learning outcomes:
Basic knowledge of the central register of final theses, licenses and copyrights, content and form of presentation of the overall results achieved in the bachelor's thesis. Basic knowledge about the preparation of a scientific article and presentation of the achieved results for popularization purposes.

Brief outline of the course:
1. Central register of final theses.
2. Licenses and Copyrights.
3. Directive on basic requirements for final theses at UPJŠ in Košice.
4. The most common mistakes in writing a final thesis.
5. Evaluation criteria and examples of assessments.
6. Preparation of a presentation for the defense of the final thesis.
7. Preparation of a scientific article.
8. Preparation of a presentation for the defense of the final thesis.
9. Preparation of a scientific article.
10. Procedure for submitting the final thesis.
11. Popularization of bachelor thesis results.
12. Presentations of the results of bachelor theses.
13. Presentations of bachelor thesis results.

Recommended literature:
1. STN 01 6910. Rules of writing and editing documents. 2011.
2. STN ISO 2145. Documentation. Numbering of sections and subsections of written documents. 1997.
3. STN ISO 690. Information and documentation. Instructions for creating bibliographic references to information sources and their citation. 2012

4. KATUŠČÁK, Dušan. How to write final and qualification theses. Enigma, 2013
5. Scientific literature related to the topic of the final thesis according to the recommendation of the thesis supervisor.

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 171

abs	n	neabs
98.83	1.17	0.0

Provides: RNDr. Miroslav Opiela, PhD., RNDr. Dávid Varga

Date of last modification: 08.01.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ SVK1/15	**Course name:** Student scientific 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: 4

Recommended semester/trimester of the course: 4., 6.

Course level: I.

Prerequisities:

Conditions for course completion:
It is required to be registered for the participation on the Student Scientific Conference (ŠVK) in accordance to the Statute of the Student Scientific Conference at PF UPJŠ and the specific conditions for participation in a given year, which are announced by the dean of the faculty. Within one year of the ŠVK, a student or a research team can register in one track only. It is also possible to apply with a written work that is an integral part of a bachelor's or master's thesis or a result of a student support program. The written work at ŠVK is the result of the student's own work or the work of the research team. 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 work presentation. Failure to do so is reason for disciplinary action. The condition for the evaluation is a successful presentation and defense of the work in the relevant track headed by a commission appointed by the dean of the faculty. The commission decides on the eligibility of credits and states its decision in the memorandum of the ŠVK.

Learning outcomes:
The student demonstrates mastery of extended theory and professional terminology of the field of study, acquisition of knowledge, skills and competences, the ability to apply them creatively in solving selected field problems, ability to present the results using appropriate presentation methods and tools and ability to actively participate in a professional discussion.

Brief outline of the course:
1. Analysis of the state of the art in the field.
2. Design and implementation of a solution to the researched problem.
3. Evaluation of achieved results.
4. Preparation of work annotation.
5. Processing the written work.
6. Preparation of results presentation.
7. Presentation and defense of the obtained results.

Recommended literature:

The recommended literature is specified individually by the student or research team in agreement with the consultant or the supervisor.

Course language:
Slovak or english

Notes:

Course assessment
Total number of assessed students: 182

A	B	C	D	E	FX
100.0	0.0	0.0	0.0	0.0	0.0

Provides:

Date of last modification: 25.01.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ SLO1a/15	**Course name:** Symbolic logic
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: 5	
Recommended semester/trimester of the course: 4.	
Course level: I.	
Prerequisities:	
Conditions for course completion: Knowledge of studied notions will be evaluated.	
Learning outcomes: To understand basic notions of symbolic logic.	
Brief outline of the course: 1. Mathematical symbols 2. Expressions 3. Interpretation 4. Value of expression 5. Standard interpretation 6. Theories and their models 7. Substitutions 8. Allowed substitutions 9. Proving system 10. Correctness of basic proving system 11. Work with logical connections 12. Work with quantifiers	
Recommended literature: 1. Krajči S., https://ics.upjs.sk/~krajci/skola/vyucba/ucebneTexty/logika-stromy.pdf 2. Goldstern M., Judah H.: The Incompleteness Phenomenon, A New Course in Mathematical Logic, A K Peters, Wellesley, Massachusetts, 1995	
Course language: Slovak	
Notes:	

Course assessment
Total number of assessed students: 447

A	B	C	D	E	FX
29.31	10.96	11.86	10.51	25.06	12.3

Provides: prof. RNDr. Stanislav Krajči, PhD.

Date of last modification: 04.01.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ TSD/19	**Course name:** Technologies of big data processing

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: 6.

Course level: I., N

Prerequisities:

Conditions for course completion:
Active participation, written test, class project.

Learning outcomes:
Practical experience with modern Big Data processing and storage systems. Introduction to their architecture and implementation.

Brief outline of the course:
1. Introduction to Big Data processing. Freely accessible datasets.
2. Cloud environment.
3. Distributed file systems, object storage. Data formats.
4. Scalability, hashing, data sharding.
5. Distributed databases, consistency trade-offs. NoSQL.
6. Batch data processing: MapReduce
7. Batch data processing: Spark I
8. Batch data processing: Spark II
9. Stream data processing: Kafka
10. Stream data processing: Beam
11. Distributed neural network training.

Recommended literature:
1. KLEPPMANN, Martin. Designing data-intensive applications: the big ideas behind reliable, scalable, and maintainable systems. Beijing: O'Reilly, 2017. ISBN 978-1-449-37332-0.
2. WHITE, Tom. Hadoop: the definitive guide. 3rd ed. Sebastopol: O'Reilly, 2012. ISBN 978-1-449-31152-0.
3. MARZ, Nathan a James WARREN. Big data: principles and best practices of scalable real-time data systems. Shelter Island, NY: Manning, [2015]. ISBN 978-1-617290-34-3.
4. PENTREATH, Nick. Machine Learning with Spark; Packt Publishing, [2015]. ISBN 978-1-783288-51-9.

Course language:
Slovak or English

Notes:

Content prerequisities: database basics, Python programming

Course assessment
Total number of assessed students: 13

A	B	C	D	E	FX
100.0	0.0	0.0	0.0	0.0	0.0

Provides: doc. RNDr. Ľubomír Antoni, PhD., RNDr. Keerthi Kumar Doreswamy, PhD.

Date of last modification: 04.01.2022

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ VADA/19	**Course name:** Vybrané aplikácie dátovej analýzy

Course type, scope and the method:
Course type: Lecture
Recommended course-load (hours):
Per week: 3 **Per study period:** 42
Course method: present

Number of ECTS credits: 3

Recommended semester/trimester of the course: 6.

Course level: I.

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

A	B	C	D	E	FX
100.0	0.0	0.0	0.0	0.0	0.0

Provides: prof. RNDr. Milan Žukovič, PhD., doc. Mgr. Štefan Parimucha, PhD., RNDr. Martin Vaľa, PhD., doc. RNDr. Marek Bombara, PhD.

Date of last modification: 28.03.2019

Approved: prof. RNDr. Gabriel Semanišin, PhD., prof. RNDr. Ivan Žežula, CSc., doc. Mgr. Jozef Kiseľák, PhD.