CONTENT

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ dCOK/24	**Course name:** Certified training course
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 4	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Completion of a certified professional/training course.	
Learning outcomes: The PhD student acquires up-to-date scientific knowledge, develops the capabilities of scientific work and familiarizes himself with the methodologies of making scientific knowledge available. He confronts his own knowledge and skills with other course participants, develops the abilities of peer discussion in the given scientific field.	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 0	

abs	n
0.0	0.0

Provides:
Date of last modification: 05.03.2024
Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dCTG/21	**Course name:** Chromatic graph theory

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

Number of ECTS credits: 5

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

Course level: III.

Prerequisities:

Conditions for course completion:
Oral exam.

Learning outcomes:
Acquired knowledge of proof techniques in chromatic graph theory.

Brief outline of the course:
Proper vertex coloring of graphs. Coloring of planar graphs. Perfect graphss.
List colorings.
Edge coloring of graphs and multigraphs.
Distance graphs and their chromatic number.
Coloring of hyergraphs.
Acyclic coloring.
Strong edge coloring. Star edge coloring.
Non-repetitive coloring.

Recommended literature:
1. L. W. Beineke, R. J. Wilson: Topics in Chromatic Graph Theory, Cambridge University Press 2015.
2. J. A. Bondy, U.S R. Murty: Graph Theory, Springer 2008.
3. G. Chartrand, P. Zhang: Chromatic graph theory, Chapman and Hall/CRC 2008.

Course language:
slovak or english

Notes:

Course assessment
Total number of assessed students: 0

N	P
0.0	0.0

Provides: doc. RNDr. Roman Soták, PhD.

Date of last modification: 12.01.2025

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ dCDC/22	**Course name:** Citation in Slovak scientific journal

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

Number of ECTS credits: 2

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Citation in a national scientific journal

Learning outcomes:
Obtaining a citation demonstrates broad and very well-founded scientific knowledge in the researched field, based on the ability to formulate research questions, to reflect on a scientific problem in such a way that generates new knowledge. At the same time, a citation in an indexed source demonstrates the competence to communicate new knowledge, which is a significant contribution to scientific knowledge, at the highest expert level.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ dCZC/22	**Course name:** Citation in international scientific journal

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

Number of ECTS credits: 4

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Obtained citation in a foreign scientific journal.

Learning outcomes:
Obtaining a citation demonstrates broad and very well-founded scientific knowledge in the researched field, based on the ability to formulate research questions, to reflect on a scientific problem in such a way that generates new knowledge. At the same time, a citation in an indexed source demonstrates the competence to communicate new knowledge, which is a significant contribution to scientific knowledge, at the highest expert level

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dCMG/22	**Course name:** Citation in monograph

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

Number of ECTS credits: 8

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Obtained citation registered in SCI or Scopus.

Learning outcomes:
Obtaining a citation demonstrates broad and very well-founded scientific knowledge in the researched field, based on the ability to formulate research questions, to reflect on a scientific problem in such a way that generates new knowledge. At the same time, a citation in an indexed source demonstrates the competence to communicate new knowledge, which is a significant contribution to scientific knowledge, at the highest expert level.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ dSPA/24	**Course name:** Co-investigator of applied research project
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 5	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Co-investigator of the applied research project	
Learning outcomes: The PhD student demonstrates the ability to participate in teamwork, to bring his own contribution to the solution of the project objective of applied research and to take responsibility for assigned tasks. By solving an applied research project, he acquires the ability to implement the project objective according to the established procedure, to follow the project schedule, to coordinate his own activities with colleagues, to participate in the creation of applied research outputs. The PhD student gains valuable experience from the practical course of a grant project with a focus on applied research	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 0	

abs	n
0.0	0.0

Provides:
Date of last modification: 05.03.2024
Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ dSVG/24	**Course name:** Co-investigator of internal grant (VVGS)
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 5	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Co-worker of project supported by internal grant schemes (VVGS)	
Learning outcomes: The PhD student demonstrates the ability to participate in teamwork, to bring his own contribution to the solution of the project objective within the internal grant system at UPJŠ. By solving the internal VVGS grant, he acquires the ability to implement the project plan according to the established procedure, adhere to the project schedule, coordinate his own activities with colleagues, and participate in the creation of outputs. The PhD student gains valuable experience from the practical course of the grant project.	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 0	
abs	n
0.0	0.0
Provides:	
Date of last modification: 05.03.2024	
Approved: prof. RNDr. Tomáš Madaras, PhD.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dSMP/22	**Course name:** Co-investigator of international project

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

Number of ECTS credits: 15

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Membership in the research team of an international project.

Learning outcomes:
Active involvement by solving a specific task within a team of international project solvers. The PhD student demonstrates the ability to work in a team, take responsibility for the assigned task, adhere to the time schedule and fulfill the project outputs. The PhD student gains personal experience from the implementation of an international project, participation in its key stages, creation of measurable outputs, grant funding of science.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 2

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ dSDP/24	**Course name:** Co-investigator of national project
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 10	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Co-investigator of the domestic project	
Learning outcomes: The PhD student demonstrates the ability to participate in teamwork, to bring his own contribution to the solution of the project objective and to take responsibility for the assigned tasks. By solving the domestic project, he acquires the ability to implement the project intention according to the established procedure, to follow the project schedule, to coordinate his own activities with colleagues, to participate in the creation of outputs. The PhD student gains valuable experience from the practical course of the grant project.	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 0	

abs	n
0.0	0.0

Provides:
Date of last modification: 05.03.2024
Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ dKOA/10	**Course name:** Combinatorial algorithms

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: 5

Recommended semester/trimester of the course: 2., 4.

Course level: III.

Prerequisities:

Conditions for course completion:
The evaluation consists of a project (30 points) and an oral exam (70 points). The semester project consists of the elaboration of a computer program that returns the optimal solution or a acceptable approximation of the optimal solution, respectively, of a selected graph problem given by a suitable representation.

Learning outcomes:
Mastery of graph algorithms. Understand the close relationship between the theoretical and algorithmic aspects of discrete mathematics. Ability to understand how selected algorithms can be derived from mathematical statements. Ability to prove the correctness of algorithms.

Brief outline of the course:
Introduction to algorithms, complexity. Basic types of algorithms - sorting algorithms, search algorithms, traversal algorithms. NP-completeness.
Trees, spanning trees, root trees. Searching in depth and in breadth. Finding all spanning trees of a graph, number of spanning trees of a graph. Minimum spanning tree problem (Kruskal's, Primov's, Boruvkov's algorithm).
Distance in graphs. Problem about the shortest path in (un)oriented (valuated) graphs (different types of algorithms) and other variants of this problem.
Introduction to network analysis, CPM method.
Flows in networks, problem on maximum flow and minimum cut, other variants of this problem.
Matching problems, matchings in bipartite and non-bipartite graphs, the problem of finding a matching with maximum value in bipartite graphs.
Center distribution, finding the center, absolute center and median of a graph.
Eulerian graphs and the Chinese postman's problem.
Hamiltonian graphs, the traveling salesman problem and approximation algorithms for TSP.

Recommended literature:
1. G. Chartrand, O.R. Oellermann: Applied and Algorithmic Graph Theory, McGraw-Hill, Inc. New York 1993.
2. J.L. Gross, J. Yellen: Graph Theory and Its Applications, Chapman & Hall/CRC 2006.
3. D. Jungnickel: Graphs, Networks, and Algorithms, Springer-Verlag Berlin 2005.

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 2

N	P
0.0	100.0

Provides: doc. RNDr. Roman Soták, PhD.

Date of last modification: 12.01.2025

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/VYMD/15	**Course name:** Computational complexity and models

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

Number of ECTS credits: 9

Recommended semester/trimester of the course: 3.

Course level: III.

Prerequisities:

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

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

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

Recommended literature:

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

Course language:
Slovak or english

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

Course assessment
Total number of assessed students: 30

N	P
0.0	100.0

Provides: prof. RNDr. Viliam Geffert, DrSc.

Date of last modification: 23.11.2021

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dDZS/24	**Course name:** Dissertation exam

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

Number of ECTS credits: 20

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Obtaining the required number of credits in the prescribed composition according to the UPJŠ study regulations, preparation and defense of the thesis, successfully completed dissertation examination.

Learning outcomes:
The PhD student demonstrated the prerequisites for successful continuation of the study by fulfilling the conditions prescribed by the study regulations for the study and scientific part of the doctoral study related to the topic of the dissertation.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 38

N	P
0.0	100.0

Provides:

Date of last modification: 08.03.2024

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dVOP/24	**Course name:** Elaboration of reviewer report

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

Number of ECTS credits: 3

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Elaboration of reviewer report

Learning outcomes:
The PhD student demonstrates broad and scientifically based knowledge in the field of study, as well as knowledge of a wide range of methods and approaches. Demonstrates the ability to critically assess a professional problem and its proposed solution, as well as to evaluate it and possibly recommend another solution. He applies knowledge and skills from the field of pedagogical sciences to his own field.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 1

abs	n
100.0	0.0

Provides:

Date of last modification: 05.03.2024

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

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

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

Number of ECTS credits: 2

Recommended semester/trimester of the course: 1.

Course level: III.

Prerequisities:

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

Learning outcomes:
The development of students´ language skills - reading, writing, listening, speaking; improvement of their linguistic competence - students acquire knowledge of selected phonological, lexical and syntactic aspects; development of pragmatic competence - students acquire skills for effective and purposeful communication, with focus on Academic English and English for specific/professional purposes, level B2.

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

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

Course language:
English, level B2 according to CEFR

Notes:

Course assessment
Total number of assessed students: 813

N	Ne	P	Pr	abs	neabs
0.0	0.0	43.79	0.0	56.09	0.12

Provides: Mgr. Zuzana Kolaříková, PhD.

Date of last modification: 06.09.2024

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: CJP/ AJD2/07	**Course name:** English Language for PhD Students 2
Course type, scope and the method: **Course type:** Practice **Recommended course-load (hours):** **Per week:** 2 **Per study period:** 28 **Course method:** distance, present	
Number of ECTS credits: 3	
Recommended semester/trimester of the course: 2.	
Course level: III.	
Prerequisities:	
Conditions for course completion: Test, oral exam in accordance with the exam requirements (available at the web-site of the LTC and in MS TEAMS)	
Learning outcomes: The development of students´ language skills - reading, writing, listening, speaking, improvement of their linguistic competence - students acquire knowledge of selected phonological, lexical and syntactic aspects, development of pragmatic competence - students can efectively use the language for a given purpose, with focus on Academic English and English for specific/professional purposes, level B2.	
Brief outline of the course: Academic communication (self-presentation, presenting at scientific meetings and conferences). Specific aspects of academic and professional English with focus on vocabulary development (formality, academic word-list), English grammar (passive voice, nominalisatio), language functions (expressing opinion, cause/effect, presenting arguments, giving examples, describing graphs/charts/schemes, etc.). Cross-language interference.	
Recommended literature: Moore, J.: Oxford Academic Vocabulary Practice. OUP, 2017. Kolaříková, Z., Petruňová, H., Timková, R.: Angličtina v akademickom prostredí (cvičebnica). UPJŠ Košice, 2021. Tomaščíková, S., Rozenfeld, J. Developing Academic English in Speaking and Writing. Vydavateľstvo ŠafárikPress, 2021. McCarthy, M., O´Dell, F.: Academic Vocabulary in Use. CUP, 2008. Štepánek, L., J. De Haff a kol.: Academic English-Akademická angličtina. Grada Publishing, a.s., 2011. Armer, T.: Cambridge English for Scientists. CUP, 2011.	
Course language: B2 level according to CEFR	
Notes:	

Course assessment
Total number of assessed students: 776

N	Ne	P	Pr	abs	neabs
0.26	0.0	94.07	1.03	4.51	0.13

Provides: Mgr. Zuzana Kolaříková, PhD., Mgr. Ivana Kupková, PhD.

Date of last modification: 03.02.2025

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dEKO/10	**Course name:** Enumeration of combinatorial objects

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

Number of ECTS credits: 7

Recommended semester/trimester of the course: 2., 4.

Course level: III.

Prerequisities:

Conditions for course completion:
A student is evaluated according to an oral examination.

Learning outcomes:
Student gets acquainted with Pólya's enumeration theory and on special examples sees how to use it when determining the number of some mathematical objects.

Brief outline of the course:
Cycle index of a permutation group. Burnside's Lemma. Pólya's Enumeration Theorem. Enumeration of injective functions. Enumeration of trees. Enumeration of graphs of given order and size. Enumeration of oriented graphs. Generalisations of Pólya's Enumeration Theorem.

Recommended literature:
F. Harary, E. M. Palmer: Graphical Enumeration, Academic Press, 1973

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 1

N	P
0.0	100.0

Provides: RNDr. Igor Fabrici, Dr. rer. nat.

Date of last modification: 17.03.2022

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dTGF/10	**Course name:** Graph theory

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: 5

Recommended semester/trimester of the course: 1.

Course level: III.

Prerequisities:

Conditions for course completion:
To complete the course, it is necessary to demonstrate the ability to formulate definitions and theorems from the lectured material together with their proofs, and to present an understanding of the connections between particular concepts and results.
The evaluation of the subject is based on the results of an oral exam (consisting of two theoretical questions).

Learning outcomes:
After completing the course, the student is acquainted with other advanced topics of graph theory, which are not covered by basic courses in discrete mathematics during the bachelor or master degree study.

Brief outline of the course:
Domination in graphs (2 weeks)
Minors and forbidden subgraphs (2 weeks)
Automorphism groups of graphs (2 weeks)
Additive and hereditary properties (3 weeks)
Graph decompositions (2 weeks)
Nowhere-zero flows (2 weeks)

Recommended literature:
J. A. Bondy and U.S.R. Murty, Graph Theory, Springer-Verlag, 2008
J.Bang-Jensen and G. Gutin: Digraphs: Theory, Algorithms and Applications, Springer-Verlag London, 2001
R. Diestel: Graph Theory, Springer-Verlag, New York, 1997
scientific journal publications

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 26

N	P
0.0	100.0

Provides: doc. RNDr. Roman Soták, PhD., prof. RNDr. Tomáš Madaras, PhD., RNDr. Igor Fabrici, Dr. rer. nat.

Date of last modification: 20.09.2021

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dTGR/10	**Course name:** Group theory

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

Number of ECTS credits: 7

Recommended semester/trimester of the course: 4.

Course level: III.

Prerequisities:

Conditions for course completion:
written and oral exam

Learning outcomes:
The students learn basic concepts and methods of group theory and their applications in various parts of mathematics.

Brief outline of the course:
Groups of symmetries, abstract groups. Subgroups, orders of elements, cyclic groups. Normal subgroups, factorization. Classification of finitely generated Abelian groups. Groups of permutations, cyclic index, Burnside´s lemma, Pólya´s theorem. Sylow´s subgroups, p-groups. Groups in linear algebra.

Recommended literature:
S. MacLane, G. Birkhoff: Algebra, Alfa Bratislava, 1973
L. Beran: Grupy a svazy, SNTL Praha, 1974
D.A.R. Wallace: Groups,rings and fields, Springer 1998
J. J. Rotman: Advanced Modern Algebra, Amer. Math. Soc., Providence 2010

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 21

N	P
0.0	100.0

Provides: doc. RNDr. Miroslav Ploščica, CSc.

Date of last modification: 08.02.2022

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ dISLa/14	**Course name:** Individual study of scientific literature I
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 12	
Recommended semester/trimester of the course: 1., 2..	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language: Slovak and English	
Notes:	
Course assessment Total number of assessed students: 42	

abs	n
100.0	0.0

Provides:
Date of last modification: 03.05.2015
Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ dISLb/14	**Course name:** Individual study of scientific literature 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: 12	
Recommended semester/trimester of the course: 3., 4..	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language: Slovak and English	
Notes:	
Course assessment Total number of assessed students: 40	

abs	n
100.0	0.0

Provides:
Date of last modification: 03.05.2015
Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ dZSP2/24	**Course name:** International study stay over 30 days
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 10	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Completion of a foreign study stay lasting more than 30 days.	
Learning outcomes: By completing the study stay, the PhD student demonstrates the ability to reflect on research problems and work critically with sources at an expert level and in an interdisciplinary context, while being able to generate new knowledge. He is able to actively communicate at an expert level in more than one language. He acts as a responsible independent scientist, works independently and in a group with the aim of pushing the boundaries of knowledge and transferring them to other areas of research, to practice and to the wider public. He can competently argue and explain his ideas	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 0	

abs	n
0.0	0.0

Provides:
Date of last modification: 05.03.2024
Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ dZSP1/24	**Course name:** International study stay up to 30 days
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 5	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Completion of a foreign study stay lasting at most 30 days.	
Learning outcomes: By completing a shorter study stay, the PhD student demonstrates the ability to reflect on research problems and work critically with sources at an expert level and in an interdisciplinary context, while being able to generate new knowledge. He is able to actively communicate at an expert level in more than one language. He acts as a responsible independent scientist, works independently and in a group with the aim of pushing the boundaries of knowledge and transferring them to other areas of research, to practice and to the wider public. He can competently argue and explain his ideas.	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 0	

abs	n
0.0	0.0

Provides:
Date of last modification: 13.01.2025
Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dTZV/10	**Course name:** Lattice theory

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

Number of ECTS credits: 5

Recommended semester/trimester of the course: 2., 4.

Course level: III.

Prerequisities:

Conditions for course completion:
Awarded according to written and oral exam.

Learning outcomes:
The students learn basic concepts and methods of Lattice theory and gain the ability to apply them in various parts of mathematics.

Brief outline of the course:
Distributive and modular lattices, Boolean algebras. Ideals, reprezentation of distibutive lattices and Boolean algebras. Completeness and completions. Algebraic properties of lattices, congruence relations. Formal concept analysis.

Recommended literature:
G.Grätzer: General Lattice Theory (2nd edition), Birkhäuser, 1998
B. A. Davey, H. A. Priestley: Introduction to lattices and order, Cambridge University Press 1990
M. Kolibiar: Algebra a príbuzné disciplíny, Alfa Bratislava, 1991

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 6

N	P
0.0	100.0

Provides: doc. RNDr. Miroslav Ploščica, CSc.

Date of last modification: 08.02.2022

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dTMT/10	**Course name:** Matroid theory

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

Number of ECTS credits: 7

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

Course level: III.

Prerequisities:

Conditions for course completion:
A student is evaluated according to an oral examination.

Learning outcomes:
A student gets acquainted with special parts of matroid theory and with possibilities how to use them in various disciplines of discrete mathematics.

Brief outline of the course:
Restriction, contraction, minor of a matroid. Connected matroids. Whitney's Theorem. Graph homeomorphisms versus matroid minors. Planar graphs and their duals. Representation of a matroid in a vector space. Binary matroids. Block designs versus matroids. Extremal problems in matroids. Greedy algorithm versus matroids.

Recommended literature:
D. J. A. Welsh: Matroid Theory, Academic Press, 1976.
J. G. Oxley, Matroid Theory, Oxford University Press, 2010.

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 1

N	P
0.0	100.0

Provides: doc. RNDr. Roman Soták, PhD.

Date of last modification: 17.03.2022

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ dPOV/24	**Course name:** Membership in conference organising commiittee
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 3	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Work in the organizing committee of the conference	
Learning outcomes: By working in the organizing committee of the conference, the PhD student demonstrates the abilities and competences to organize a scientific or professional event independently or in a team, to manage the implementation in terms of time and content, to communicate effectively verbally and in writing using various technical means as needed, including in a foreign language at a professional level with various types of people, if necessary, correctly recommend solutions or make independent decisions.	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 0	
abs	n
0.0	0.0
Provides:	
Date of last modification: 05.03.2024	
Approved: prof. RNDr. Tomáš Madaras, PhD.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dUAS/10	**Course name:** Ordered algebraic structures

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: 5

Recommended semester/trimester of the course: 2., 4.

Course level: III.

Prerequisities:

Conditions for course completion:
examination

Learning outcomes:
To gain a basic orientation in the methods of modern algebra. Acquire the basics of the theory of ordered algebraic structures, which to combine with the acquired knowledge of algebra, extend them and generalize; knowledge to apply to specific problems and mathematical problems. The aim is to have sufficient mathematical knowledge and apparatus to enable the independent solution of various problems related to scientific research and the publication of these results.

Brief outline of the course:
Partially ordered, linearly ordered, lattice ordered groups. Convex subgroups, absolute value and orthogonality, order of factor classes. Archimedean ordered structures. Partially ordered and linearly ordered rings, fields, lattice ordered rings.

Recommended literature:
L.Fuchs: Partially ordered algebraic systems, Pergamon Press, 1963.
T.S.Blyth: Lattices and Ordered Algebraic Structures, Springer Verlag, London, 2005.
E.Harsheim: Ordered sets, Springer Verlag, 2005.
G.Grätzer: Universal algebra, Second Edition, Springer 2008.

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 4

N	P
0.0	100.0

Provides: prof. RNDr. Danica Studenovská, CSc., doc. RNDr. Miroslav Ploščica, CSc.

Date of last modification: 24.11.2021

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: KPE/ PgVU/17	**Course name:** Pedagogy for University Teachers

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

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
1. Development of a teaching diary—100%
2. Compulsory active participation and attendance in accordance with the Study Regulations.

Learning outcomes:
After completing the course, the student will acquire knowledge, skills, and competencies, i.e., will be able to:
Knowledge
Define and apply basic didactic principles, methods, forms, and tools in the teaching process of university-level professional subjects. Identify and specify educational procedures of a university teacher aimed at effective teaching management, pedagogical diagnostics, and assessment of learning outcomes. Recognize different approaches to pedagogical evaluation and their impact on improving the quality of the educational process at the university level.
Skills
Implement effective educational methods and techniques into the teaching of professional subjects, tailored to the needs of university students. Conduct pedagogical diagnostics, assess students' progress, and apply appropriate evaluation methods to improve learning outcomes. Analyze and reflect on one's own teaching process, identify areas for improvement, and enhance the teaching of professional subjects, including the rationalization of the time and content structure of teaching. Present specific proposals for improving the teaching process, including the use of new technologies and innovative pedagogical approaches.
Competencies
Confidently and effectively manage the teaching of university subjects, applying educational competencies that consider the specifics of higher education. Critically reflect on one's own pedagogical practice and the learning outcomes of students to improve teaching methods and achieve a higher quality of the educational process. Apply innovative solutions to streamline and optimize the teaching process, aiming to increase the engagement and success of university students.

Brief outline of the course:
The personality of a university teacher. Teaching styles. Student in university education. Student learning styles. Possibilities of adapting teaching styles and student learning styles. University teacher–student interaction and communication in the teaching process. Pedagogical competencies

of a university teacher. Didactic analysis of the curriculum; teaching materials and textbooks. Forms of university teaching. Methods of university teaching. Verification methods and student assessment. Creation of a didactic test. Designing university teaching process. University teacher self-reflection.

Recommended literature:

Beránek, J. (2023). Moderní pedagogické metody a přístupy. Praha: Portál.
Fiala, M. (2023). Didaktika a metodika v současné škole. Praha: Grada Publishing.
Kováč, M. (2023). Vzdelávanie v 21. storočí: Inovatívne prístupy a metódy. Nitra: Vydavateľstvo UKF v Nitre.
Koudelka, J. (2023). Moderní didaktika a její aplikace. Praha: Karolinum.
Křížová, M., & Šebová, P. (2023). Vzdělávání učitelů: Teoretické a praktické přístupy. Praha: Triton.
Kučerová, M. (2023). Vzdělávání učitelů a profesionální rozvoj. Praha: Triton.
Mocová, M., & Lázňovská, M. (2023). Pedagogika a jej aplikácie v praxi. Bratislava: Vydavateľstvo Spolku slovenských pedagogických pracovníkov.
Novák, J., & Pol, M. (2024). Pedagogické výzkumy a inovace ve vzdělávání. Praha: Portál.
Sikora, J. (2022). Didaktika a metodika vzdelávania: Nové výzvy a trendy. Bratislava: Vydavateľstvo Univerzity Komenského v Bratislave.
Škoda, J. (2022). Efektivní výuka: Praktické strategie a metody. Praha: Grada Publishing.
Švec, J. (2023). Didaktika a školní politika: Teorie a praxe. Praha: Grada Publishing.
Vojtová, K. (2024). Diferenciace a inkluze ve vzdělávání. Praha: Wolters Kluwer.

Course language:
slovak

Notes:

Course assessment
Total number of assessed students: 152

abs	n	neabs
98.03	0.66	1.32

Provides: doc. PaedDr. Renáta Orosová, PhD.

Date of last modification: 14.09.2024

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ dODP/24	**Course name:** PhD thesis 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: 30	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 1

N	P
0.0	100.0

Provides:
Date of last modification: 26.03.2024
Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dPLT/10	**Course name:** Polyhedral theory

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

Number of ECTS credits: 7

Recommended semester/trimester of the course: 4.

Course level: III.

Prerequisities:

Conditions for course completion:
To complete the course, it is necessary to demonstrate the ability to formulate definitions and theorems from the lectured material together with their proofs, and to present an understanding of the relationships between particular concepts and results.
The evaluation of the subject is based on the results of an oral exam (consisting of two theoretical questions).

Learning outcomes:
After completing the course, the student will be acquainted with basic overview of the theory of convex polyhedra and polyhedral maps.

Brief outline of the course:
Week 1: Polyhedra, complexes, maps, planar graphs.
Week 2: Basic properties of three-dimensional convex polyhedra (operations with polyhedra, Euler's formula and its consequences).
Week 3: Platonic, Archimedean and related polyhedra.
Weeks 4 - 6: Characterization of graphs of convex polyhedra, Steinitz's theorem.
Week 7: Hamiltonian polyhedra.
Week 8: The longest cycles in convex polyhedra.
Week 9: Face vectors of polyhedra, Eberhard's theorem.
Weeks 10 - 11: Local structure of polyhedra.
Week 12: Sphere inscribability and circumscribability of polyhedra.
Week 13: Applications of polyhedra in sciences.

Recommended literature:
E. Jucovič: Konvexné mnohosteny, Veda Bratislava 1981
B. Grunbaum: Convex polytopes (2nd edition), Springer New York, 2003
G.M. Ziegler: Lectures on Polytopes, Springer-Verlag, New York, 1996
S. Jendrol', H.-J. Voss: Light subgraphs of graphs embedded in the plane - a survey, Discrete Math. 313 (2013), 406-421

Course language:
Slovak and English

Notes:
Basic knowledge of geometry and advanced knowledge of graph theory are assumed.

Course assessment
Total number of assessed students: 5

N	P
0.0	100.0

Provides: prof. RNDr. Tomáš Madaras, PhD.

Date of last modification: 14.09.2021

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dPPV/24	**Course name:** Popularisation of science

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

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Active involvement in the popularization of science.

Learning outcomes:
Demonstrated ability to present science to the lay public, use interactive methods of scientific communication, identify the target group and adapt the communication language to the level of professional knowledge. A PhD student is able to arouse interest and motivate specific target groups in the field of his scientific work, but also in the wider context of science.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 05.03.2024

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dPZK/24	**Course name:** Presentation of results at international conference

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

Number of ECTS credits: 10

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Active participation in an international conference abroad.

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 05.03.2024

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dPDK/24	**Course name:** Presentation of results at local conference

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

Number of ECTS credits: 2

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Active participation in the home conference.

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 05.03.2024

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ dPDZ/24	**Course name:** Presentation of results at local conference with international participation

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

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Active participation in a national conference with foreign participation.

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 1

abs	n
100.0	0.0

Provides:

Date of last modification: 05.03.2024

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ dPSM/24	**Course name:** Presentation of results in seminar
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 5	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Presentation at the seminar	
Learning outcomes: By actively participating in the seminar, the PhD student demonstrates the ability to identify, evaluate, and apply correct scientific methods or research methodology in his field of study. He demonstrates the ability to reflect on a specific scientific problem by using the latest approaches and applying them critically. Demonstrates competence in using existing theories and concepts in an innovative way, as well as generating new original scientific knowledge and communicating research results by adequate means and through Slovak or a foreign language.	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 0	

abs	n
0.0	0.0

Provides:
Date of last modification: 05.03.2024
Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dZVG/24	**Course name:** Principal investigator of internal grant (VVGS)

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

Number of ECTS credits: 10

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Principal investigator of an internal grant (VVGS)

Learning outcomes:
The PhD student demonstrates the ability to process a successful application for his own research problem within the internal grant system at UPJŠ. Acquires skills with the design of research stages, their time schedule, measurable outputs and adequate distribution of funds. The very solution of the internal VVGS grant acquires the ability to implement the project intention according to the established procedure, to be responsible for achieving the set outputs. As a responsible researcher, the PhD student acquires competencies in project management, its administration, and presentation of results.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 05.03.2024

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ dPMK/10	**Course name:** Probability method in combinatorics

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

Number of ECTS credits: 7

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

Course level: III.

Prerequisities:

Conditions for course completion:
In the covered areas of the probabilistic method, the ability to formulate definitions and statements, to present proofs of statements, to explain the individual steps in proofs and to mention possibilities of application is required.
The evaluation is based on an oral exam.

Learning outcomes:
Introduction to the randomness in graph theory and applications of the probabilistic method in combinatorics and graph theory. The obtained overview of the ways of using basic results of probability in proving the existence of objects with the required properties, understanding of various forms of this method and knowledge of possible applications.

Brief outline of the course:
1. Probability Theory (probability space, event, probability, random variable, expectation, random graph)
2. Probabilistic Method - First Moment Principle (Ramsey numbers, hypergraph coloring, intersecting sets system/Kneser graph, pairs of sets)
3. Linearity of Expectation (Hamiltonian graphs, splitting graphs)
4. Alterations (Markov's inequality, independent sets, high girth and high chromatic number)
5. The Second Moment (Chebyshev’s inequality, threshold functions, the clique number)
6. The Lovász Local Lemma (hypergraph coloring again, directed cycles)
7. Chernoff bound

Recommended literature:
1. N. Alon, J. Spencer: The Probabilistic Method, John Wiley, 1991
2. M. Molloy, B. Reed: Graph Colourings and the Probabilistic Method, Springer, 2002
3. J. Matoušek, J. Vondrák: The Probabilistic Method, Lecture Notes, 2002

Course language:
Slovak

Notes:

Course assessment Total number of assessed students: 12	
N	P
0.0	100.0
Provides: RNDr. Igor Fabrici, Dr. rer. nat.	
Date of last modification: 19.10.2021	
Approved: prof. RNDr. Tomáš Madaras, PhD.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: KPPaPZ/PsVU/17	**Course name:** Psychology for University Lecturers

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

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Case study, micro-output, its analysis
Current modifications of the course are listed in the electronic bulletin board of the course.

Learning outcomes:
After completing the course, students will gain knowledge that allows them to understand, summarize and explain selected psychological knowledge from cognitive psychology, emotion and motivation psychology, personality psychology, developmental, social, educational psychology and health psychology. They will acquire skills to apply the above psychological knowledge necessary for the professional, competent performance of university teaching practice of doctoral students to create and implement the teaching of a professional topic with applied psychological knowledge and develop the competences to create and implement teaching of a professional topic with the application of psychological knowledge, as well as to evaluate their performance and the performance of their classmates in the form of constructive feedback.

Brief outline of the course:
The content of the course is based on selected psychological knowledge of cognitive psychology, psychology of emotions and motivation, personality psychology, developmental, social, educational psychology and health psychology. Teaching is realized by a combination of lectures with interactive, experiential methods, discussion, open communication with mutual respect, support of independence, activity and motivation of students. Syllabus: University teacher and his work in the teaching process with a focus on: teachers in relation to themselves (cognitive, personal, social and competencies in the use of methods), in relation to students and as part of the teacher-student relationship on the basis of selected areas of cognitive psychology, psychology of emotions and motivation, developmental psychology, social psychology, educational psychology and health psychology with application to the university environment

Recommended literature:
Alexitch, L. R. (2005). Applying social psychology to education. Social Psychology.–Ed.: Schneider F., Gruman J., Coutts L.–Sage Publications, Inc, 205-228.
Fry, H., Ketteridge, S., & Marshall, S. (2008). A handbook for teaching and learning in higher education: Enhancing academic practice. Routledge.
Mareš, J.: Pedagogická psychologie. Portál, 2013.

Kniha psychologie. Universum, 2014
Čáp, J., Mareš, J.: Psychologie pro učitele. Praha: Portál 2007.
Vágnerová, M.: Školní poradenská psychológie pro pedagogy. Praha: Karolínum 2005.
Cuevas, J. A., Childers, G., & Dawson, B. L. (2023). A rationale for promoting cognitive science in teacher education: Deconstructing prevailing learning myths and advancing research-based practices. Trends in neuroscience and education, 100209.

Course language:
slovak

Notes:

Course assessment
Total number of assessed students: 87

abs	n	neabs
98.85	0.0	1.15

Provides: PhDr. Anna Janovská, PhD.

Date of last modification: 09.12.2024

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dPDC/24	**Course name:** Publication in local journal

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

Number of ECTS credits: 6

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Publication accepted in a national journal as author/co-author.

Learning outcomes:
By publishing in a national journal as an author/co-author, the PhD student demonstrates a high level of ability to identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The PhD student demonstrates the ability to critically evaluate and respond to reviewers' suggestions, to finalize his own ideas.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 12.03.2024

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dPNZ/24	**Course name:** Publication in non-reviewed proceedings

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

Number of ECTS credits: 2

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
A publication published in a non-reviewed foreign or national journal as an author/co-author.

Learning outcomes:
By publishing in a non-reviewed foreign or national journal as an author/co-author, the PhD student demonstrates the ability to identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The phD student demonstrates the ability to finalize his own thoughts in a written speech.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 05.03.2024

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dCSC/24	**Course name:** SCI or Scopus citation

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

Number of ECTS credits: 8

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Obtained citation registered in SCI or Scopus.

Learning outcomes:
Obtaining a citation demonstrates broad and very well-founded scientific knowledge in the researched field, based on the ability to formulate research questions, to reflect on a scientific problem in such a way that generates new knowledge. At the same time, a citation in an indexed source demonstrates the competence to communicate new knowledge, which is a significant contribution to scientific knowledge, at the highest expert level.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 05.03.2024

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dQ1M/24	**Course name:** Scientific publication in Q1 journal

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

Number of ECTS credits: 30

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Publication accepted in a journal of category Q1 as co-author.

Learning outcomes:
By publishing in a journal of category Q1 as a co-author, the PhD student demonstrates a high degree of ability to identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The PhD student demonstrates the ability to critically evaluate and respond to reviewers' suggestions, to finalize his own ideas.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 11.03.2024

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dQ1V/24	**Course name:** Scientific publication in Q1 journal with significant author's contribution

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

Number of ECTS credits: 40

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Publication accepted in a journal of category Q1 with author's share at least 25%.

Learning outcomes:
By publishing in a journal of category Q1 as the first or corresponding author, the PhD student demonstrates a high degree of ability to identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The PhD student demonstrates the ability to critically evaluate and respond to reviewers' suggestions, to finalize his own ideas. A significant author's share will have a substantial impact on the number and quality of the publication results, on the implementation of software support for research, and on the formal processing of the publication itself in terms of content and graphics.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 13.01.2025

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dQ2M/24	**Course name:** Scientific publication in Q2 journal

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

Number of ECTS credits: 20

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Publication accepted in a journal of category Q2 as co-author.

Learning outcomes:
By publishing in a journal of category Q2 as a co-author, the PhD student demonstrates a high degree of ability to identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The PhD student demonstrates the ability to critically evaluate and respond to reviewers' suggestions, to finalize his own ideas.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 11.03.2024

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/dQ2V/24	**Course name:** Scientific publication in Q2 journal with significant author's contribution

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

Number of ECTS credits: 30

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Publication accepted in a journal of category Q2 with author's share at least 25%.

Learning outcomes:
By publishing in a journal of category Q2 as the first or corresponding author, the PhD student demonstrates a high degree of ability to identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The PhD student demonstrates the ability to critically evaluate and respond to reviewers' suggestions, to finalize his own ideas. A significant author's share will have a substantial impact on the number and quality of the publication results, on the implementation of software support for research, and on the formal processing of the publication itself in terms of content and graphics.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 13.01.2025

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dQ3M/24	**Course name:** Scientific publication in Q3 journal

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

Number of ECTS credits: 15

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Publication accepted in a journal of category Q3 as co-author.

Learning outcomes:
By publishing in a journal of category Q3 as a co-author, the PhD student demonstrates a high degree of ability to identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The PhD student demonstrates the ability to critically evaluate and respond to reviewers' suggestions, to finalize his own ideas.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 11.03.2024

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/dQ3V/24	**Course name:** Scientific publication in Q3 journal with significant author's contribution

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

Number of ECTS credits: 25

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Publication accepted in a journal of category Q3 with author's share at least 25%.

Learning outcomes:
By publishing in a journal of category Q3 as the first or corresponding author, the PhD student demonstrates a high degree of ability to identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The PhD student demonstrates the ability to critically evaluate and respond to reviewers' suggestions, to finalize his own ideas. A significant author's share will have a substantial impact on the number and quality of the publication results, on the implementation of software support for research, and on the formal processing of the publication itself in terms of content and graphics.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 13.01.2025

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dQ4M/24	**Course name:** Scientific publication in Q4 journal

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

Number of ECTS credits: 10

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Publication accepted in a journal of category Q4 as co-author.

Learning outcomes:
identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The PhD student demonstrates the ability to critically evaluate and respond to reviewers' suggestions, to finalize his own ideas.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 11.03.2024

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dQ4V/24	**Course name:** Scientific publication in Q4 journal with significant author's contribution

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

Number of ECTS credits: 20

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Publication accepted in a journal of category Q4 with author's share at least 25%.

Learning outcomes:
By publishing in a journal of category Q4 as the first or corresponding author, the PhD student demonstrates a high degree of ability to identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The PhD student demonstrates the ability to critically evaluate and respond to reviewers' suggestions, to finalize his own ideas. A significant author's share will have a substantial impact on the number and quality of the publication results, on the implementation of software support for research, and on the formal processing of the publication itself in terms of content and graphics.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 13.01.2025

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dPZC/24	**Course name:** Scientific publication in international journal

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

Number of ECTS credits: 8

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Publication accepted in a foreign journal as an author/co-author.

Learning outcomes:
By publishing in a foreign journal as an author/co-author, the PhD student demonstrates a high level of ability to identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The PhD student demonstrates the ability to critically evaluate and respond to reviewers' suggestions, to finalize his own ideas.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 12.03.2024

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dPRZ/24	**Course name:** Scientific publication in peer-reviewed proceedings

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

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
A publication published in a peer-reviewed foreign or national proceedings as an author/co-author.

Learning outcomes:
By publishing in a peer-reviewed foreign or national journal as an author/co-author, the PhD student demonstrates a high degree of ability to identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The PhD student demonstrates the ability to critically evaluate and respond to reviewers' suggestions, to finalize his own ideas.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 05.03.2024

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dVTGa/10	**Course name:** Selected topics in graph theory I

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

Number of ECTS credits: 7

Recommended semester/trimester of the course: 2.

Course level: III.

Prerequisities:

Conditions for course completion:
To complete the course, it is necessary to demonstrate the ability to formulate definitions and theorems from the lectured material together with their proofs, and to present an understanding of the relationships between particular concepts and results.
The evaluation of the subject is based on the results of an oral exam (consisting of two theoretical questions).

Learning outcomes:
After completing the course, the student is acquainted with specific topics of graph theory which are not covered by basic or advanced courses in discrete mathematics during the bachelor or master degree study, and which are the subject of research of teams, whose members contribute to supervision of the doctoral program Discrete Mathematics.

Brief outline of the course:
Discharging method in graph theory (5 weeks)
3-colourability of graphs (4 weeks)
Graph colourings with constraints on colour neighbourhoods of vertices (4 weeks)

Recommended literature:
Recent publications from international scientific journals.

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 25

N	P
0.0	100.0

Provides: doc. RNDr. Roman Soták, PhD., prof. RNDr. Tomáš Madaras, PhD., RNDr. Igor Fabrici, Dr. rer. nat.

Date of last modification: 20.09.2021

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dVTGb/10	**Course name:** Selected topics in graph theory II

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

Number of ECTS credits: 7

Recommended semester/trimester of the course: 3.

Course level: III.

Prerequisities:

Conditions for course completion:
To complete the course, it is necessary to demonstrate the ability to formulate definitions and theorems from the lectured material together with their proofs, and to present an understanding of the relationships between particular concepts and results.
The evaluation of the subject is based on the results of an oral exam (consisting of two theoretical questions).

Learning outcomes:
After completing the course, the student is acquainted with specific topics of graph theory which are not covered by basic or advanced courses in discrete mathematics during the bachelor or master degree study, and which are the subject of research of teams, whose members contribute to supervision of the doctoral program Discrete Mathematics.

Brief outline of the course:
Facial colourings of plane graphs (4 weeks)
Fractional and circular graph colourings (4 weeks)
Monounary algebras (3 weeks)
Chemical graph theory (3 weeks)

Recommended literature:
Recent literature from international scientific journals.

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 25

N	P
0.0	100.0

Provides: doc. RNDr. Roman Soták, PhD., prof. RNDr. Tomáš Madaras, PhD.

Date of last modification: 20.09.2021

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ dSVU/24	**Course name:** Software in public repository
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 5	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: A created software product stored in a public repository.	
Learning outcomes: The PhD student demonstrates the ability to create a stand-alone or supporting software product in a form that can be used by other researchers.	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 0	

abs	n
0.0	0.0

Provides:	
Date of last modification: 13.01.2025	
Approved: prof. RNDr. Tomáš Madaras, PhD.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

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

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

Number of ECTS credits: 2

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

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

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

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

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

Course language:

Notes:

Course assessment
Total number of assessed students: 203

abs	n
100.0	0.0

Provides: doc. RNDr. Marián Kireš, PhD.

Date of last modification: 08.11.2022
Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dPZR/24	**Course name:** Submitted scientific work

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

Number of ECTS credits: 10

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Scientific work after being sent to the editorial office as an author/co-author.

Learning outcomes:
By sending a manuscript to the editors of a scientific journal as an author/co-author, the PhD student demonstrates a high degree of ability to identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The PhD student demonstrates the ability to formulate his own ideas in a structured form.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 05.03.2024

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ dVSS/24	**Course name:** Supervision of student scientific work
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 8	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Supervision of Student's Scientific Activity	
Learning outcomes: By guiding a student within the SOČ or ŠVOČ, the PhD student demonstrates broad and scientifically based knowledge in the field of study, as well as knowledge of a wide range of methods and approaches. Demonstrates the ability to critically assess a professional problem and its proposed solution, as well as to evaluate it and possibly propose another solution. He applies knowledge and skills from the field of pedagogical sciences to his own field.	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 0	

abs	n
0.0	0.0

Provides:
Date of last modification: 05.03.2024
Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ dPPC1/24	**Course name:** Teaching activities 1 h/s
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 2	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Direct teaching activity 1 semester hour	
Learning outcomes: Through pedagogical activity, the PhD student demonstrates the ability to transfer and integrate knowledge from his own field of study into education. He is able to select and apply the right techniques and strategies of study group management, higher education and evaluation of learning outcomes. He is capable of designing and implementing part of the educational process in accordance with current trends in higher education and the requirements placed on the level of communication and digital competencies.	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 0	

abs	n
0.0	0.0

Provides:
Date of last modification: 05.03.2024
Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ dPPC2/24	**Course name:** Teaching activities 2 h/s
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 4	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Direct teaching activity 2 semester hours	
Learning outcomes: Through pedagogical activity, the PhD student demonstrates the ability to transfer and integrate knowledge from his own field of study into education. He is able to select and apply the right techniques and strategies of study group management, higher education and evaluation of learning outcomes. He is capable of designing and implementing part of the educational process in accordance with current trends in higher education and the requirements placed on the level of communication and digital competencies.	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 0	

abs	n
0.0	0.0

Provides:
Date of last modification: 05.03.2024
Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ dPPC3/24	**Course name:** Teaching activities 3 h/s

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

Number of ECTS credits: 6

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Direct teaching activity 3 semester hours

Learning outcomes:
Through pedagogical activity, the PhD student demonstrates the ability to transfer and integrate knowledge from his own field of study into education. He is able to select and apply the right techniques and strategies of study group management, higher education and evaluation of learning outcomes. He is capable of designing and implementing part of the educational process in accordance with current trends in higher education and the requirements placed on the level of communication and digital competencies.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 05.03.2024

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ dPPC4/24	**Course name:** Teaching activities 4 h/s
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 8	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Direct teaching activity 4 semester hours	
Learning outcomes: Through pedagogical activity, the PhD student demonstrates the ability to transfer and integrate knowledge from his own field of study into education. He is able to select and apply the right techniques and strategies of study group management, higher education and evaluation of learning outcomes. He is capable of designing and implementing part of the educational process in accordance with current trends in higher education and the requirements placed on the level of communication and digital competencies.	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 0	

abs	n
0.0	0.0

Provides:
Date of last modification: 05.03.2024
Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dTPG/14	**Course name:** Theory of planar graphs

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

Number of ECTS credits: 7

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

Course level: III.

Prerequisities:

Conditions for course completion:
To complete the course, it is necessary to demonstrate the ability to formulate definitions and theorems from the lectured material together with their proofs, and to present an understanding of the relationships between particular concepts and results.
The evaluation of the subject is based on the results of an oral exam (consisting of two theoretical questions).

Learning outcomes:
After completing the course, the student will be acquainted with basic and advanced topics related to planar and plane graphs.

Brief outline of the course:
Fundamentals of topology of the plane.
Planar and planar graphs, outerplanar graphs.
Characterization theorems for planarity.
Euler's formula and its consequences.
Local structure of planar and plane graphs, the discharging method method.
Separators in planar graphs.

Recommended literature:
T. Nishizeki, N. Chiba: Planar graphs: Theory and Algorithms, Dover Publications, 2008.
S. Jendroľ, H-J. Voss: Light subgraphs of graphs embedded in the plane - A survey, Discrete Mathematics Vol. 313, no. 4 (2013) 406-421.

Course language:
Slovak and English

Notes:

Course assessment
Total number of assessed students: 0

N	P
0.0	0.0

Provides: prof. RNDr. Tomáš Madaras, PhD.
Date of last modification: 09.01.2025
Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dKZP/24	**Course name:** Thesis consultant

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

Number of ECTS credits: 4

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Final thesis consultant.

Learning outcomes:
By consulting the final thesis, the PhD student demonstrates broad and scientifically based knowledge in the field of study, as well as knowledge of a wide range of methods and approaches. Demonstrates the ability to critically assess a professional problem and its proposed solution, as well as to evaluate it and possibly propose another solution. He applies knowledge and skills from the field of pedagogical sciences to his own field.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 05.03.2024

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ dVZP/24	**Course name:** Thesis supervising
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 8	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Supervisor of the final thesis.	
Learning outcomes: By supervising the final thesis, the PhD student demonstrates broad and scientifically based knowledge in the field of study, as well as knowledge of a wide range of methods and approaches. Demonstrates the ability to critically assess a professional problem and its proposed solution, as well as to evaluate it and possibly propose another solution. He applies knowledge and skills from the field of pedagogical sciences to his own field.	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 0	

abs	n
0.0	0.0

Provides:
Date of last modification: 05.03.2024
Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ dTTG/10	**Course name:** Topological graph theory

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

Number of ECTS credits: 7

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

Course level: III.

Prerequisities:

Conditions for course completion:
Exam

Learning outcomes:
To obtain knowledge on basic methods and results of Topological Graph Theory.

Brief outline of the course:
Planar graphs. Surfaces. Embeddings. Voltage graphs and covering spaces. The genus of a graph. The genus of a group. Colorings of embedded graphs. Unavoidable configurations. Representativity of embedded graphs. Treewidth of graphs. Minors. Forbidden configurations for surfaces.

Recommended literature:
1. G. Gross, T.W. Tucker: Topological Graph Theory, John Wiley and Sons, New York, 1987
2. B. Mohar, C., Thomassen: Graphs on Surfaces,The Johns Hopkins University Press, Baltimore, 2001
3. G. Ringel: Map Color Theorem, Springer-Verlag, Berlin, 1974
4. Journal articles

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 19

N	P
0.0	100.0

Provides: doc. RNDr. Roman Soták, PhD., prof. RNDr. Tomáš Madaras, PhD.

Date of last modification: 09.01.2025

Approved: prof. RNDr. Tomáš Madaras, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ dUAL/10	**Course name:** Universal algebra

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: 5

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

Course level: III.

Prerequisities:

Conditions for course completion:
Exam consisting of a written test and of a oral examination.

Learning outcomes:
To achieve a basic orientation in the methods of modern algebra. Follow up on the acquired knowledge of algebra, expand it and generalize; gain additional knowledge of universal algebra and be able to apply it to specific situations. The aim is to have sufficient mathematical knowledge and apparatus to enable the independent solution of various problems related to scientific research and the publication of these results.

Brief outline of the course:
Relations, operations, algebraic structures. Congruences, homomorphism and isomorphism theorems. Application to abstract automata and other structures. Automorphism groups and endomorphism monoids of algebraic structures, abstract and concrete representation problem. Subalgebras. Direct and subdirest product. Direct and inverse limit of algebras. Terms. Free algebras. Birkhoff theorems about varieties. Structures and 1st order logic.

Recommended literature:
G. Grätzer: Universal Algebra, 2nd Edition, Springer Verlag, Berlin - New York, 2008.
S.Burris, H.P.Sankappanavar: A Course in Universal Algebra. Springer-Verlag, 1981;
online http://orion.math.iastate.edu/cliff/BurrisSanka.pdf.
V.P.Snaith: Groups, Rings and Galois Theory, Word Scientific Publ. Co.,New Jersey-London-Singapore, 2003.
M. Kolibiar a kol.: Algebra a príbuzné disciplíny, Bratislava, 1992.
B. Jónsson: Topics in Universal Algebra, Springer-Verlag, 1972.

Course language:
Slovak and English

Notes:

Course assessment Total number of assessed students: 6	
N	P
0.0	100.0
Provides:	
Date of last modification: 24.11.2021	
Approved: prof. RNDr. Tomáš Madaras, PhD.	