CONTENT

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ APS/10	**Course name:** Applied statistics

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

Number of ECTS credits: 6

Recommended semester/trimester of the course: 2.

Course level: II.

Prerequisities:

Conditions for course completion:
Given at the basis of statistical processing of real data. Final evaluation is given at the basis of partial examination, computing part, and oral part of the exam.

Learning outcomes:
Learning most frequently applied statistical methods.

Brief outline of the course:
o Matrices and linear spaces, g-inversions, projections
o Normal distribution and related distributions
o Hotelling's test
o Probability foundations of regression and correlation
o General linear model with full rank
o Model with incomplete rank
o Submodels testing
o Regression analysis, basic models
o Assesing the quality of a model
o Analysis of variance
o One-way ANOVA, multiple comparison procedures, problem of heteroskedasticity
o Balanced factorial models, hierarchical models
o Analysis of covariance
o Statistical software for linear modeling

Recommended literature:
• Rao: Linear statistical inference and its applications, Wiley, 1973
• Seber: Linear regression analysis, Wiley, 1977
• Searle: Linear models, Wiley, 1997
• Sen, Srivastava: Regression analysis (Theory, Methods, and Applications), Springer, 1990
• Christensen: Plane answers to complex questions (The Theory of Linear Models), Springer, 1987

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 60

A	B	C	D	E	FX
3.33	8.33	18.33	15.0	31.67	23.33

Provides: prof. RNDr. Ivan Žežula, CSc.

Date of last modification: 14.04.2022

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ VMO/22	**Course name:** Calculus of variations in optimization

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

Number of ECTS credits: 6

Recommended semester/trimester of the course: 2.

Course level: II.

Prerequisities:

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

Learning outcomes:
Students will learn to find local extremes of functionals, especially to derive variational integrals. They will be able to verify the necessary and sufficient conditions for the existence of global and local extrema for specific functionals, find extremals in the case of one-dimensional integrals, and determine whether they are weak or strong extremes. Use theoretical results for examples from geometry, physics, chemistry or financial mathematics.

Brief outline of the course:
Abstract variational calculus in Banach space - critical points, extremals, sufficient conditions for the existence of a (global) minimizer and its uniqueness. Differentiability in Banach spaces (Gateaux and Fréchet derivative, variation of functionals). Euler's necessary condition (Beltrami's identity) and Lagrange's sufficient condition of local extremes. Lagrange's multipliers method. Courant-Weinstein principle and Rayleigh's quotient. Ekeland's principle of variation. Rayleigh-Ritz method. The mountain pass theorem. Least squares method in spaces with infinite dimension. Bayesian variational methods. Discrete variational calculus. Du Bois-Reymond, Legendre and Weierstrass necessary conditions. Lavrentiev phenomenon. Conjugate points method. Sufficient conditions for weak and strong extremes. Hamilton-Jacobi equation. Geometric and physical aspects of calculus of variations (minimum areas, harmonic representations, central tendency measures, curvature equations, isoperimetric problem, geodetic calculation, Lagrange and Hamiltonian formulation of mechanics, Legendre transform, Fermat's principle).

Recommended literature:
1. K. Rektorys: Variační metody, Academia - nakladatelství, ISBN: 80-200-0714-8, 602 s.,1999.
2. J. Bouchala: Variační metody, https://mi21.vsb.cz/sites/mi21.vsb.cz/files/unit/variacni_metody.pdf, 2012.
3. Cassel, Kevin W.: Variational Methods with Applications in Science and Engineering, Cambridge University Press, 2013.

4. Elsgolc, L.E.: Calculus of Variations, Courier Corporation, ISBN 9780486457994, 2007.

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 7

A	B	C	D	E	FX
57.14	42.86	0.0	0.0	0.0	0.0

Provides: doc. Mgr. Jozef Kiseľák, PhD.

Date of last modification: 19.04.2022

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

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

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

Number of ECTS credits: 6

Recommended semester/trimester of the course: 2.

Course level: II.

Prerequisities:

Conditions for course completion:
The evaluation consists of projects (30 points) and an exam (70 points). The semester projects consist of the elaboration of computer programs that return the optimal solution or acceptable approximations of the optimal solutions, of selected graph problems given by suitable representations.

Learning outcomes:
Understanding of basic graph algorithm, the close connection 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:
Basic notions from graph theory.
Introduction to algorithms and complexity. Basic types of algorithms - sorting algorithms, search algorithms, greedy algorithms. NP-completeness.
Trees, spanning trees and rooted trees. Depth first search, breadth first search. Generating of all spanning trees of a graph, number of spanning trees. Minimum spanning tree problem (Kruskal, Prim, and Boruvka´s algorithms).
Distance in graphs. Shortest path problem in (non)oriented (weighted) graphs (various types of algorithms) and other variations of this problem.
Introduction to network analysis, critical path method.
Flows in networks, the max-flow min-cut theorem and related concepts.
Matchings, maximum matchings in bipartite and general graphs, finding a matching with maximum weight in bipartite graphs.
Location of centers in graphs, finding a center, absolute center, and a median of a graph.
Eulerian graphs and Chinese postman's problem.
Hamiltonian graphs, Travelling 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.

4. J. Plesník: Grafové algoritmy, Veda Bratislava 1983.

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 110

A	B	C	D	E	FX
36.36	24.55	21.82	8.18	6.36	2.73

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

Date of last modification: 06.02.2025

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ KDZ/10	**Course name:** Combinatorial designs

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: 4

Recommended semester/trimester of the course: 3.

Course level: II.

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, to present the proofs of theorems and to solve selected problems based on theory of combinatorial designs.
The exam itakes written form by elaborating a test containing three questions of a theoretical nature and two questions of a practical / computational nature; the maximum number of points that can be obtained for answering each question is 20. To pass the exam, it is necessary to obtain more than half of the maximum number of 100 points (otherwise the exam is evaluated by FX), while the rating E is given in the case of point range 51-59, D in case of 60-69, C in case of 70-79, B in case of 80-89 and A in case of more than 90 points.

Learning outcomes:
After completing the course, the student is acquainted with the basics of the theory of combinatorial designs, its applications in the natural sciences and relations to other parts of mathematics.

Brief outline of the course:
Week 1: Motivational problems using combinatorial designs, definition and basic properties of BIBDs.
Week 2: Incidence matrix of a design and its properties.
Week 3: Constructions of BIBDs.
Week 4: Symmetrical BIBDs, derived and residual design.
Week 5: Order of symmetric BIBD, its relation to the number of points.
Week 6: Finite projective planes.
Week 7: Hadamard designs and Hadamard matrices.
Week 8: Conditions for the existence of symmetric BIBDs, Lagrange's four-square theorem.
Week 9: Bruck-Ryser-Chowla theorem and its consequences.
Week 10 and 11: Steiner triple systems and their constructions.
Week 12: Orthogonal Latin squares, orthogonal arrays.
Week 13: Strongly regular graphs.
Week 14: Selected applications of combinatorial designs (group testing of samples, sharing of secret information).

Recommended literature:

I. Anderson, I. Honkala: A short course in combinatorial designs, http://www.utu.fi/~honkala/cover.html
D.R. Stinson: Combinatorial Designs: Constructions and Analysis, Springer 2004
W.D. Wallis: Combinatorial designs, Marcel Dekker 1988

Course language:
Slovak or English

Notes:
Basic knowledge of arithmetic, linear algebra and graph theory is required, as well as basic knowledge of working with the Maple computer algebra system.

Course assessment
Total number of assessed students: 78

A	B	C	D	E	FX
32.05	19.23	24.36	19.23	5.13	0.0

Provides: prof. RNDr. Tomáš Madaras, PhD.

Date of last modification: 14.04.2022

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ VSM/10	**Course name:** Computational statistics and simulation methods

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

Number of ECTS credits: 5

Recommended semester/trimester of the course: 3.

Course level: II.

Prerequisities:

Conditions for course completion:
Written tests. Final evaluation is given at the basis of partial examination, written and oral part of exam.

Learning outcomes:
Getting to know modern software and computational and simulation methods in statistics.

Brief outline of the course:
o Types of statistical computations, popular mathematical software
o Computing distribution and quantile functions
o Matrix computations
o Random numbers generation:
a) Uniform distribution (linear reccurent generators, bit reccurent generators, nonlinear generators)
b) General methods for other distributions
c) Special methods for other distributions
o Simulations
o Approximate evaluation of an integral
o Bootstrap method
o Random processes and MCMC method
o Introduction to Exploratory data analysis
o Principles of cluster analysis
o Principal component analysis
o Factor analysis
o GUHA method

Recommended literature:

• Olehla, Věchet, Olehla: Řešení úloh matematické statistiky ve Fortranu, Nadas, 1982
• Olver et al.: NIST Handbook of mathematical functions, NIST and Cambridge University Press, 2010
• Deák: Random number generators and simulation, Akadémiai kiadó, 1990
• Fishman: Monte Carlo. Concepts, Algorithms, and Applications., Springer, 1996
• Backhaus, Erichson, Plinke, Weiber: Multivariate Analysemethoden, 7th ed., Springer, 1994
• Tan, Steinbach, Kumar: Introduction to Data Mining, Pearson Education Ltd., 2014

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 65

A	B	C	D	E	FX
20.0	20.0	24.62	9.23	21.54	4.62

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

Date of last modification: 14.04.2022

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚINF/ DBS/15	**Course name:** Database systems for Mathematicians

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

Number of ECTS credits: 6

Recommended semester/trimester of the course: 3.

Course level: I., II.

Prerequisities:

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

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

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

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

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

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 745

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

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

Date of last modification: 08.01.2022

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ DPP1a/22	**Course name:** Diploma project 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: 1	
Recommended semester/trimester of the course: 1.	
Course level: II.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 12	

abs	n
100.0	0.0

Provides:
Date of last modification: 24.08.2022
Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ DPP1b/22	**Course name:** Diploma project II
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** present	
Number of ECTS credits: 2	
Recommended semester/trimester of the course: 2.	
Course level: II.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 10	

abs	n
100.0	0.0

Provides:
Date of last modification: 24.08.2022
Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ DPP1c/22	**Course name:** Diploma project III
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: 3.	
Course level: II.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 17	

abs	n
100.0	0.0

Provides:
Date of last modification: 24.08.2022
Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ DPP1d/22	**Course name:** Diploma project IV
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: 4.	
Course level: II.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 17	

abs	n
100.0	0.0

Provides:
Date of last modification: 24.08.2022
Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/DPO/22	**Course name:** Diploma thesis and its defence

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

Number of ECTS credits: 16

Recommended semester/trimester of the course:

Course level: II.

Prerequisities:

Conditions for course completion:
The diploma thesis is the result of the student's own work. It must not show elements of academic fraud and must meet the criteria of good research practice defined in the Rector's Decision no. 21/2021, which lays down the rules for assessing plagiarism at Pavol Jozef Šafárik University in Košice and its components. Fulfillment of the criteria is verified mainly in the process of supervision and in the process of thesis defense. Failure to do so is reason for disciplinary action.

Learning outcomes:
The diploma thesis demonstrates mastery of extended theory and professional terminology of the field of study, acquisition of knowledge, skills and competencies in accordance with the declared profile of the graduate of the study program, as well as the ability to apply them creatively in solving selected field problems. Student demonstrates the ability of independent professional work in terms of content, formal and ethical. Further details on the diploma thesis are determined by Directive no. 1/2011 on the basic requirements of final theses and the Study Regulations of UPJŠ in Košice.

Brief outline of the course:
1. Elaboration of the diploma thesis in accordance with the instructions of the supervisor.
2. Presentation of the results of the diploma thesis before the examination commission.
3. Answering questions related to the topic of the diploma thesis within the discussion.

Recommended literature:
The recommended literature is determined individually in accordance with the topic of the diploma thesis.

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 14

A	B	C	D	E	FX
71.43	7.14	14.29	0.0	7.14	0.0

Provides:
Date of last modification: 19.04.2022
Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ FAN/22	**Course name:** Functional analysis

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

Number of ECTS credits: 6

Recommended semester/trimester of the course: 1.

Course level: II.

Prerequisities:

Conditions for course completion:
exam

Learning outcomes:
Understanding of the basic rigorous ideas of Applied Functional Analysis.

Brief outline of the course:
Linear spaces. Algebraic base and dimension. Linear operators and functionals. Algebraic dual spaces. Linear topological space. Locally convex space. Normed space. L(p) spaces. Dual spaces of L(p) spaces. Hilbert space. Applications of Baire category theorem. Open mapping theorem. Closed graph theorem. Hahn-Banach theorem. Spectrum of linear compact operator.

Recommended literature:
A. M. Bruckner, J. B. Bruckner, B. S. Thomson: Real Analysis, Prentice Hall, 1997.
B. P. Rynne, M. A. Youngson: Linear Functional Analysis, Springer-Verlag, 2008.

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 47

A	B	C	D	E	FX
19.15	10.64	10.64	17.02	34.04	8.51

Provides: prof. RNDr. Ondrej Hutník, PhD., RNDr. Jaroslav Šupina, PhD.

Date of last modification: 11.01.2025

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ THR/22	**Course name:** Game theory

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

Number of ECTS credits: 6

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

Course level: II.

Prerequisities:

Conditions for course completion:
Two written exams dring the semester (solving problems), presentation of an interesting model. The final assessment is based on the written tests and oral examination.

Learning outcomes:
Knowledge of basic models of noncooperative and cooperative game theory, solution methods and applications of game-theoretic models in economics and everyday life.

Brief outline of the course:
Examples of games. Extensive form of a game, value of the game. Von Neumann Morgenstern utility theory. Matrix games and their solution methods: geometric, linear programming . Bimatrix games. Nash equilibrium and its computation. Negotiations theory. Cooperative n-person games: core, Shapley value. Economic applications of game theory.

Recommended literature:
1. K. Binmore, Fun and games, D.C. Heath, 1992
2. G. Owen, Game Theory, Academic Press (existuje ruský preklad).
3. A.R. Karlin, Y.Peres, Game theory alive, American Mathematical Society, 2017
4. L.C. Thomas, Games, Theory and Applications, Wiley, New York.
5. H.S. Bierman, L. Fernandez, Game Theory with Economic Applications, Addison-Wesley, 1998.

Course language:
Slovak

Notes:
The students should have basic knowledge in probability theory and linear programming (including duality theory and simplex method).

Course assessment
Total number of assessed students: 97

A	B	C	D	E	FX
22.68	21.65	23.71	16.49	13.4	2.06

Provides: prof. RNDr. Katarína Cechlárová, DrSc.
Date of last modification: 24.11.2024
Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ TIN/22	**Course name:** Information theory

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

Number of ECTS credits: 5

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

Course level: II.

Prerequisities:

Conditions for course completion:
A student is evaluated according to an oral examination during which he/she answers two questions chosen by him/her at random, one from the group A and one from the group B (both for 50 points at maximum). Evaluation scale: A ... 90-100 p., B ... 80-89 p., C ... 70-79 p., D ... 60-69 p., E ... 50-59 p., FX ... 0-49 p.

Learning outcomes:
A student gets acquainted with a mathematical attempt to solve some problems of computer science.

Brief outline of the course:
A quantitative characteristic of an information. Entropy of a random variable. Mutual information. Inequalities involving mutual information and entropy, respectively. Typical sequence, typical set. Data compression.

Recommended literature:
T. M. Cover, J. A. Thomas, Elements of Information Theory, Wiley, 1991 (2nd ed. 2006)
T. K. Moon, Information Theory (free online course materials), available at the address http://digitalcommons.usu.edu/ocw_ece/3/
S. Palúch, Teória informácie, Žilinská univerzita, Žilina 2007
J. Černý, Entropia a informácia v kybernetike, Alfa, Bratislava 1981

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 41

A	B	C	D	E	FX
58.54	4.88	12.2	4.88	19.51	0.0

Provides: prof. RNDr. Ondrej Hutník, PhD.

Date of last modification: 19.04.2022

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ MPA/19	**Course name:** Markov's processes and their applications

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

Number of ECTS credits: 6

Recommended semester/trimester of the course: 1.

Course level: II.

Prerequisities:

Conditions for course completion:
Total evaluation based on 2 written tests (2x40p) + assignment (5p) and oral exam (40p).
At least 50% must be obtained from each part.
Final evaluation: ≥90% A; ≥80% B; ≥70% C; ≥60% D; ≥50% E; <50% FX.

Learning outcomes:
Student should:
1. Obtain the knowledge about modelling of real stochastic processes.
2. Apply theoretical knowledge in practical problems solving in queuing and renewal theory.
3. Obtain basic skills with CAS software SageMath based on Python.

Brief outline of the course:
1. Stochastic (random) processes (definition, characteristics, classification of processes).
2. Markov chains (Markov property, transition matrix, discrete-time Markov chains).
3. Classification of states of the process.
4. Evaluation of transitions, optimal strategies, Howard´s algorithm.
5. Special chains with continuous time (continuous-time Markov chains, intensity of transition, Kolmogorov´s differential equations, Poisson process).
6. Birth-and-death processes.
7. Applications in queuing theory (Kendall´s classification of queuing systems, efficiency indicators, opened systems without waiting).
8.-9. Opened systems with waiting, closed systems.
10. Applications in renewal theory and reliability. Markov chains in discrete renewal models.
11. Renewal process with continuous time.
12. Reliability of the system of elements.
13. Limit theorems of renewal theory.

Recommended literature:
1. Skřivánková V., Hančová M.: Náhodné procesy a ich aplikácie, UPJŠ, Košice, 2018 (in Slovak)
2. Beichelt F.: Applied Probability and Stochastic Processes, 2nd Ed., Chapman and Hall, 2016
3. Ross S. M.: Introduction to Probability Models, 13th ed., Elsevier, 2023
4. Janková, K. a kol. Markovove reťazce a ich aplikácie, epos, 2014 (in Slovak)

5. Prášková Z., Lachout P.: Základy náhodných procesu, MFF UK, Praha, 2020 (in Czech)

Course language:
Slovak

Notes:
The students are required to have basic knowledge about axiomatical theory of probability, distributions and characteristics of random variables.

Course assessment
Total number of assessed students: 98

A	B	C	D	E	FX
24.49	18.37	19.39	19.39	15.31	3.06

Provides: doc. RNDr. Martina Hančová, PhD., RNDr. Andrej Gajdoš, PhD.

Date of last modification: 21.11.2024

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ MTE/22	**Course name:** Mathematical economics

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

Number of ECTS credits: 5

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

Course level: II.

Prerequisities:

Conditions for course completion:
Two written exams in solving problems. Final evaluation is based on written exams and theoretical oral exam.

Learning outcomes:
To learn basic notions and methods of the modern mathematical economics.

Brief outline of the course:
The notion of exchange economy. Edgeworth box. Preferences and utility functions. Optimality in exchange economies. Existence of core. Walrasian equilibrium. Optimality and decentralization. Production economies. Exchange economies with indivisible goods. Housing market, computational complexity.

Recommended literature:
1. C.D. Aliprantis, D.J. Brown, O. Burkinshaw: Existence and optimality of competitive equilibria, Springer 1989
2. W. Hildenbrand, A.P. Kirman: Equilibrium analysis, North Holland, 1988
3. A. Takayama: Mathematical economics, Cambridge University Press, 1985
4. Journal publications

Course language:
Slovak

Notes:
The subject uses methods of convex programming, topology, game theory. The knowledge of basic notions of Microeconomics is recommended.

Course assessment
Total number of assessed students: 90

A	B	C	D	E	FX
24.44	22.22	17.78	21.11	10.0	4.44

Provides: prof. RNDr. Katarína Cechlárová, DrSc.

Date of last modification: 24.11.2024

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ MSE/14	**Course name:** Mathematical methods in economics, finance and insurance
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: II.	
Prerequisities:	
Conditions for course completion: Acquiring the required number of credits in the structure defined by the study plan.	
Learning outcomes: Evaluation of student‘s competences with respect to the profile of the graduate.	
Brief outline of the course: The state examination is performed in a form of a debate with the emphasis on one topic of the following courses: ÚMV/MPA/19, ÚMV/NPR/19, ÚMV/APS/10, ÚMV/MMF/10 , ÚMV/ THR/22, ÚMV/MTE/22 . 1. Probability distributions of random vectors and their characteristics. 2. Types of convergence of random variables and limit theorems. 3. Markov chains and processes. 4. Modelling queueuing systems. 5. Measuring dependence of random variables and regression models. 6. Analysis of variance and covariance. 7. Time series analysis. 8. Portfolio theory, characteristics of portfolio and modelling financial markets. 9. Exchange economy with infinitely divisible goods, core and equilibrium. 10. Exchange economy with indivisible goods, algorithms. 11. Games of two players. 12. Cooperative games of n players.	
Recommended literature:	
Course language: Slovak	
Notes:	

Course assessment
Total number of assessed students: 28

A	B	C	D	E	FX
28.57	25.0	28.57	14.29	3.57	0.0

Provides:

Date of last modification: 05.12.2024

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ MMF/10	**Course name:** Mathematical methods in finance

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

Number of ECTS credits: 6

Recommended semester/trimester of the course: 2.

Course level: II.

Prerequisities:

Conditions for course completion:
Written tests during the semester. Final evaluation is based on written tests and oral exam.

Learning outcomes:
To provide stochastic methods for investments, financial market analysis and financial forecasting.

Brief outline of the course:
Financial markets, institutions and instruments. Stochastic methods of valuation of financial products. Risk and return, analysis of portfolio of securities. Characteristics of portfolio, mean and variance, measures of dependencies. Admissible, efficient and optimal portfolio. Indiference curves, utility functions. Financial market models. Markowitz´s mean-variance model and its modifications, model of capital market line (CML). Sharpe´s model and its modifications. Capital assets pricing model (CAPM), security market line model (SML). Decomposition of total risk, market risk and specific risk. Diversification of portfolio. Measurement of performance. Investment and financial decisions. Financial derivatives, their classification and pricing. Financial time series and their decomposition. Analytical and adaptive methods of smoothing. Financial forecasting. Hypothesis of randomness.

Recommended literature:
1. Skřivánková V.-Skřivánek J.: Kvantitatívne metódy finančných operácií, IURA Edition, Bratislava, 2006.
2. Elliott R.J.-Kopp P.E.: Mathematics of Financial Markets, Springer, New York, 2005.
3. Janssen at al.: Mathematical Finance, ISTE / Wiley, 2009.
4. Ross S.M.: Mathematical Finance, Cambridge University Press, 2011.
5. Sharpe W.F.- Alexander G.J.: Investments, Prentice-Hall, New Jersey,1994.
6. Shreve S.E.: Stochastic Calculus for Finance, Springer, 2004.

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 57

A	B	C	D	E	FX
14.04	24.56	15.79	29.82	15.79	0.0

Provides: Mgr. Katarína Lučivjanská, PhD.

Date of last modification: 21.03.2022

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ MTV/20	**Course name:** Mathematical theory of voting and elections

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

Number of ECTS credits: 4

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

Course level: II.

Prerequisities:

Conditions for course completion:
Final evaluation is given by continuous assessment, project and oral exam.

Learning outcomes:
To know various voting systems, their properties, modelling and analysis using quantitative methods. Students are able to construct counterexamples, paradoxes, verify properties, design algorithms and understand principles of computational complexity analysis. Historical and political context is stressed.

Brief outline of the course:
1. Historical examples, examples of paradoxes: Condorcet, Borda. Basic formal definitions.
2. Elections with two candidates. May's theorem.
3. Voting systems: plurality, approval, Borda, scoring systems. Properties of scoring systems. Saari's theorems and Fishburn's theorem.
4.Other properties of voting systems: monotonicity, Paroto optimality, independence. Impossibility theorems.
5. Condorcet, Copeland, Llul, Copelandov-alfa, Dodgso systems. Computational complexity of winner determination.
6. Election manipulation. Gibbard-Sattertwaite theorem.
7. Complexity of manipulation.
8. Other models: incomplete information, possible and necessary winner.
9. Proportional reprezentation. Paradoxes. Divisor and quota methods. Balinski-Young theorem.
10. Extension of proportional representation: combining proportionality with personal elections, voting districts.
11. Electoral college
12. Students' presentations.

Recommended literature:
1. E. A. Robinson, D. H. Ullmann: A mathematical look at politics, CRC Press, 2010
2. J. Rothe (ed.): Economics and Computation, Springer, 2016
3. F. Brandt, V. Conitzer, U. Endriss, J. Lang, A.D. Procaccia: Handbook of computational social choice, Cambridge University Press, 2016
4. F. Pukelsheim, Proportional Representation, Springer, 2013

5. Donald G. Saari, Geometry of Voting, 1994
6. Sherif El-Helaly: TheMathematics of Voting and Apportionment, Birkhäuser, 2019
7. G. G. Szpiro, Numbers rule, Princeton University Press, 2010

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 3

A	B	C	D	E	FX
33.33	66.67	0.0	0.0	0.0	0.0

Provides: prof. RNDr. Katarína Cechlárová, DrSc.

Date of last modification: 24.11.2024

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: KF/FMPV/22	**Course name:** Methodology of Science 1

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

Number of ECTS credits: 2

Recommended semester/trimester of the course:

Course level: II.

Prerequisities:

Conditions for course completion:
Attendance: A student may have one unexcused absence in seminar at the most. Absence in more than one seminar must be reasoned and substituted by consultations. Conditions of continuous and final control: during the semester a student is continuously checked and assessed according to his/her activity. To be awarded the credits, a student must pass a test from knowledge obtained in the lectures and seminars. Results of the test will make up the final grade.

Learning outcomes:
The course is aimed at getting familiar with the basic issues of methodology and philosophy of science. Significant part will be devoted to presenting the main concepts of the philosophy of science in the 20th century and this aim will be achieved by reading the source and interpretive texts.

Brief outline of the course:
• Falsificationism and critical realism by K. R. Popper.
• Development and critique of the Popper's concept.
• Understanding the science development in the work by T. S. Kuhn.
• Methodology of scientific research programmes of I. Lakatos.
• Methodological anarchism of P. Feyerabend.
• W.V.O. Quine – the issue of relation between theory and empiricism.

Recommended literature:
BILASOVÁ, V. – ANDREANSKÝ, E.: Epistemológia a metodológia vedy. Prešov: FF PU 2007.
FAJKUS, B.: Filosofie a metodologie vědy. Praha: Academia 2005.
BEDNÁRIKOVÁ, M. Úvod do metodológie vied. Trnavská univerzita: Trnava 2013.
DÉMUTH, A. Filozofické aspekty dejín vedy. Trnavská univerzita: Trnava 2013.
FEYERABEND, P.: Proti metodě. Prel. J. Fiala. Praha: Aurora 2001.
KUHN, T. S.: Štruktúra vedeckých revolúcií. Prel. Ľ. Valentová. Bratislava 1982.

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 6

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

Provides: prof. PhDr. Eugen Andreanský, PhD.

Date of last modification: 01.02.2022

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚBEV/ MOB2/10	**Course name:** Molecular Biology

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

Number of ECTS credits: 3

Recommended semester/trimester of the course: 2.

Course level: I., II.

Prerequisities:

Conditions for course completion:

Learning outcomes:
Familiarize students with the structure, properties and functions of information macromolecules and their work, focusing primarily on the molecular mechanisms of regulation of DNA replication, gene expression and cell cycle.

Brief outline of the course:
1. Structure and properties of information biomacromolecules.
2. Chromatine molecular structure and dynamics and oragnization of chromosome.
3. Replication of chromosomal and extrachromosomal DNAs.
4. Mutations and DNA reapir.
5. Prokaryotic and eukaryotic genome. Human genome.
6. Mobile gene elements.
7. Transcription and postranscription processing of RNA.
8. Translation and posttraslational modification of proteins. Protein degradation.
9. Interaction of proteins with DNA. Regulation of gene expression in prokaryots.
10. Regulation of gene expression in eukaryots.
11. Cell signaling.
12. Cell cycle and cell cycle control.

Recommended literature:
E. Mišúrová:Molekulárna biológia. Učebné texty, PF UPJŠ Košice, 1999
E. Mišúrová, P. Solár: Molekulová biológia. Učebné texty, PF UPJŠ, 2007
S.Rosypal:Úvod do molekulární biologie. Grafex Blansko, Brno,1999
D.P. Clark: Molecular Biology, Elsevier Academic Press, London, 2005
D.P. Clark, N.Pazdernik, M. McGehee: Molecular Biology, 3rd Edition, Elsevier 2018

Course language:

Notes:

Course assessment
Total number of assessed students: 1

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

Provides: doc. RNDr. Peter Pristaš, CSc., univerzitný profesor, RNDr. Zuzana Jendželovská, PhD.

Date of last modification: 19.12.2021

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ VRS/14	**Course name:** Multidimensional statistical methods

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

Number of ECTS credits: 4

Recommended semester/trimester of the course: 2.

Course level: II.

Prerequisities:

Conditions for course completion:
Given at the basis of partial examination and working out an individual project.

Learning outcomes:
To learn to use the most widely used multivariate methods of data processing practically.

Brief outline of the course:
Multivariate data, graphical visualization. Multivariate normal distribution. Inference for multivariate normal distribution. Dimension reduction - principal component analysis, factor analysis. Multidimensional scaling. Cluster analysis. Odds and risk ratios. Logistic regression.

Recommended literature:
1. W. Härdle, L. Simar. Applied multivariate statistical analysis. Heidelberg: Springer, 2019
2. W. Härdle, Z. Hlávka: Multivariate statistics: Exercises and solutions. New York: Springer, 2007
3. R.A. Johnson, D.W. Wichern. Applied multivariate statistical analysis. Upper Saddle River, N.J: Pearson Prentice Hall, 2014 (6. vydanie)
4. B. Everitt and T. Hothorn. An introduction to applied multivariate analysis with R. New York: Springer, 2011
5. D.J. Bartholomew et al. Analysis of multivariate social science data. Chapman & Hall, 2008 (2. vydanie)

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 16

A	B	C	D	E	FX
50.0	31.25	12.5	0.0	6.25	0.0

Provides: doc. RNDr. Daniel Klein, PhD.

Date of last modification: 27.01.2022

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ TOR/22	**Course name:** Optimal control theory
Course type, scope and the method: **Course type:** Lecture / Practice **Recommended course-load (hours):** **Per week:** 2 / 2 **Per study period:** 28 / 28 **Course method:** present	
Number of ECTS credits: 6	
Recommended semester/trimester of the course: 1., 3.	
Course level: II.	
Prerequisities:	
Conditions for course completion: Based on two written tests during the semester and on the oral examination.	
Learning outcomes: To learn the basic notions and applications of the theory of controllable systems.	
Brief outline of the course: The notion of a controllable system. Examples of mechanical, electrical, biological and economic systems. Controllable set and its properties. Theorem on complete controllability of a linear system. Pontrjagins maximum principle and its variants. Transversality conditions. Optimal control of linear systems, bang-bang principle, switching points, singular regulations. Applications of theoretical results in practical problems. Modelling of economic and financial systems.	
Recommended literature: 1. D.G. Zill, M. R. Cullen Differential Equations with Boundary-Value Problems, Brooks/Cole, Cengage Learning, 2005 2. S.S. Sethi, Optimal control theory, Applications to management science and economics, Springer, 2021 3. J. Macki, A. Strauss, Introduction to Optimal Control Theory, Springer, Berlin, 1980. 4 L.M. Hocking, Optimal control, an introduction to the theory with applications, Clarendon Press; 1991 5. M. Vlach, Optimální řízení regulovatelných systému, SNTL, Praha, 1975. 6. G. Feichtinger, R.F. Hartl: Optimale Kontrolle okonomischer Prozesse, Berlin, 1986.	
Course language: Slovak	
Notes: The students are required to have basic knowledge about differential equations. Properties of convex sets are recommended.	

Course assessment Total number of assessed students: 95					
A	B	C	D	E	FX
24.21	27.37	22.11	13.68	12.63	0.0
Provides: prof. RNDr. Katarína Cechlárová, DrSc.					
Date of last modification: 24.11.2024					
Approved: prof. RNDr. Katarína Cechlárová, DrSc.					

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: KF/ FILA/22	**Course name:** Philosophical Antropology

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

Number of ECTS credits: 2

Recommended semester/trimester of the course:

Course level: II.

Prerequisities:

Conditions for course completion:

Learning outcomes:

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

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

Provides: doc. PhDr. Kristína Bosáková, PhD.

Date of last modification: 01.02.2022

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ TRZ/15	**Course name:** Risk 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: 3

Recommended semester/trimester of the course: 4.

Course level: II.

Prerequisities:

Conditions for course completion:
Based on written tests and oral exam. Project elaborated in statistical software.

Learning outcomes:
To give theoretical knowledge in stochastic modelling and managing of insurance risk process and the elements of ruin theory.

Brief outline of the course:
The conception of risk in insurance. Classification of risks. Individual and collective risk models. Probability distributions of individual claims. Distribution of the total number of claims and of the of aggregated claim size. Compound distributions, their characteristics and moment generating functions. Mixed distributions (Pólya, Waring, Delaporte) and their use. Distribution of extremal claims (Fréchet, Weibull, Gumbel, Pareto). The ruin problem. The risk process as special random process. Cramér- Lundberg model and its modification. Ruin probability approximations. Bayes ´s methods in risk theory and the princip of credibility. Risk management using reinsurance and bonus-malus systems.

Recommended literature:
1. Buhlmann H.: Mathematical Methods in Risk Theory, Springer, Berlin, 1996.
2. Daykin at al.: Practical risk theory for actuarial. Chapman and Hall, 1994.
3. Embrechts at l.: Modelling extremal events for insurance and finance. Springer, 1997.
4. Horáková a kol.: Teória rizika v poistení. Wolters Kluwer, Bratislava, 2015.
5. Mikosch T.: Non-Life Insurance Mathematics, Springer, Berlin, 2009.

Course language:
Slovak

Notes:
???

Course assessment Total number of assessed students: 18					
A	B	C	D	E	FX
22.22	22.22	22.22	16.67	11.11	5.56
Provides: Mgr. Katarína Lučivjanská, PhD.					
Date of last modification: 19.04.2022					
Approved: prof. RNDr. Katarína Cechlárová, DrSc.					

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚTVŠ/ CM/13	**Course name:** Seaside Aerobic Exercise

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

Number of ECTS credits: 2

Recommended semester/trimester of the course:

Course level: II.

Prerequisities:

Conditions for course completion:
Completion: passed
Condition for successful course completion:
- active participation in line with the study rule of procedure and course guidelines
- effective performance of all tasks- aerobics, water exercise, yoga, Pilates and others

Learning outcomes:
Content standard:
The student demonstrates relevant knowledge and skills in the field, which content is defined in the course syllabus and recommended literature.
Performance standard:
Upon completion of the course students are able to meet the performance standard and:
- perform basic aerobics steps and basics of health exercises,
- conduct verbal and non-verbal communication with clients during exercise,
- organise and manage the process of physical recreation in leisure time

Brief outline of the course:
Brief outline of the course:
1. Basic aerobics – low impact aerobics, high impact aerobics, basic steps and cuing
2. Basics of aqua fitness
3. Basics of Pilates
4. Health exercises
5. Bodyweight exercises
6. Swimming
7. Relaxing yoga exercises
8. Power yoga
9. Yoga relaxation
10. Final assessment

Students can engage in different sport activities offered by the sea resort – swimming, rafting, volleyball, football, table tennis, tennis and other water sports in particular.

Recommended literature:
1. BUZKOVÁ, K. 2006. Fitness jóga. Praha: Grada. 167 s.

2. ČECHOVSKÁ, I., MILEROVÁ, H., NOVOTNÁ, V. Aqua-fitness. Praha: Grada. 136 s.
3. EVANS, M ., HUDSON, J., TUCKER, P. 2001. Umění harmonie: meditace, jóga, tai-či, strečink. 192 s.
4. JARKOVSKÁ, H., JARKOVSKÁ, M. 2005. Posilováni s vlastním tělem 417 krát jinak. Praha: Grada. 209 s.
5. KOVAŘÍKOVÁ, K. 2017. Aerobik a fitness. Karolium, 130 s.

Course language:
Slovak language

Notes:

Course assessment
Total number of assessed students: 62

abs	n
9.68	90.32

Provides: Mgr. Agata Dorota Horbacz, PhD.

Date of last modification: 29.03.2022

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚINF/ BPS/25	**Course name:** Security of computer networks

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

Number of ECTS credits: 5

Recommended semester/trimester of the course: 3.

Course level: II.

Prerequisities:

Conditions for course completion:
The requirements for completing the course are:
1. Active participation in exercises (20% of the total score),
2. Homework assignments (30% of the total score),
3. Written exam (50% of the total score).

Learning outcomes:
Understand the nature and importance of network security threats and methods for securing computer networks. Be able to identify security vulnerabilities and implement security measures, including the use of standard network security technologies such as firewalls, intrusion detection and prevention systems, and honeypots. Understand the principles and risks of security protocols like SSL and IPsec and know how to use them. Be capable of collecting and analyzing network security data and logs from network security devices.

Brief outline of the course:
1. Introduction to network security. Network situational awareness.
2. Data transmission security at the data link layer of the communication model, data flow management in local networks, switching, STP, virtualization, MACsec, multiprotocol switching.
3. Security of wireless networks and transmissions, WLAN networks, authentication mechanisms for WDS, data transmission over mobile networks (GSM, LTE).
4. Remote access to local networks, EAP authentication, RADIUS protocol, trust management, certificate usage, certification process, tasks of a certification authority.
5. Security of IPv4 and IPv6 network protocols, potential attacks and protection, IPsec protocol, security associations and policies, cryptographic information exchange.
6. Security of transport protocols TCP and UDP, TLS protocol, securing data in TLS sessions, tunneling, VPN.
7. Security aspects of Internet application-layer protocols, DNSSEC.
8. Security gateway architecture (firewall), demilitarized zone, filtering rules.
9. Security information and event management. Analysis and aggregation of network data.
10. Intrusion detection and prevention, honeypots. Approaches to data analysis.
11. Network monitoring. Flow analysis.
12. Analysis and prediction of situational awareness.

Recommended literature:

1. Kizza, Joseph Migga. Guide to Computer Network Security. 6th ed., Springer, 2024.
2. Van Oorschot, Paul C. Computer Security and the Internet: Tools and Jewels from Malware to Bitcoin. Springer, 2020.
3. Andress, Jason. Cyber Operations: Building, Defending, and Attacking Modern Computer Networks. Apress, 2019.

Course language:

Slovak or English

Notes:

Content prerequisites: To complete the course, knowledge from the courses ÚINF/PSIN/15 - Computer network Internet and ÚINF/UIB1/21 - Introduction to information security is assumed. The course is not organized every year.

Course assessment

Total number of assessed students: 31

A	B	C	D	E	FX
25.81	16.13	19.35	12.9	22.58	3.23

Provides: doc. RNDr. JUDr. Pavol Sokol, PhD. et PhD., RNDr. Tomáš Bajtoš, PhD., RNDr. Rastislav Krivoš-Belluš, PhD.

Date of last modification: 18.11.2024

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: KF/ FIVYC/22	**Course name:** Selected Topics in Philosophy of Education (General Introduction)

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

Number of ECTS credits: 2

Recommended semester/trimester of the course:

Course level: II.

Prerequisities:

Conditions for course completion:

Learning outcomes:

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 2

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

Provides: PhDr. Dušan Hruška, PhD.

Date of last modification: 27.04.2022

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ VKP/10	**Course name:** Selected topics in probability

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: II.

Prerequisities:

Conditions for course completion:
Evaluation is based on written and oral part of the exam.

Learning outcomes:
Perspective of probability from the standpoint of measure theory. Understanding of most important results of probability theory.

Brief outline of the course:
• Probability and measure
o Set systems, random variables and measure
o Distribution functions and their properties
o Independence
o Radon-Nikodym derivative of measure
• Characteristics of random variables
o Moment characteristics
o Characteristic and genarating functions
o Quantile characteristics
o Conditional densities and conditional mean values
o Transformations of random variables, convolutions
• Important probability distributions
o Discrete distributions
o Absolute continuous distributions
• Convergence of sequences of random variables
o Types of convergence (a.s., Lp, P, D)
o Laws of large numbers
o Central limit theorems

Recommended literature:
• Štěpán: Teorie pravděpodobnosti, Academia, 1987
• Loeve: Probability theory, Van Nostrand, 1960
• Rényi: Foundations of Probability, Holden-Day, 1970
• Athreya, Lahiri: Measure Theory and Probability Theory, Springer, 2006

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 67

A	B	C	D	E	FX
11.94	13.43	14.93	14.93	34.33	10.45

Provides: prof. RNDr. Ivan Žežula, CSc.

Date of last modification: 19.04.2022

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚMV/ SHMa/22	**Course name:** Seminar on history of mathematics I

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

Number of ECTS credits: 2

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

Course level: I., II.

Prerequisities:

Conditions for course completion:
Conditions for continuous evaluation:
1. Participation in teaching in accordance with the study rules and instructions of the teacher.
2. Activity.
3. Homework and tests.
4. Seminar work and its presentation at the seminar – poster from history of mathematics on the selected topic
Conditions for successful completion of the course:
1. Participation in teaching in accordance with the study regulations and according to the instructions of the teacher;
2. Credits will be awarded to students who score at least 50% on homework assignments and tests. Additional points can be achieved for the presentation of a seminar paper.

Learning outcomes:
The student knows the main stages of the development of mathematics, the history of the development of the language of mathematics, the development of selected concepts and some mathematical disciplines. The student understands the parallels between the phylogeny and ontogeny of mathematical thinking.

Brief outline of the course:
Prehistory, ontogeny and phylogeny.
Mathematics in ancient cultures: Egypt, Mesopotamia, China, India.
Mathematics in ancient Greece: Origins of Greek natural philosophy and mathematics. The discovery of incommensurability and its consequences (Pythagoras and his school). Classical problems of Greek mathematics. Problems with infinity (Zeno). Eudoxus' method. Plato, Aristotle, Euclid and his Foundations. Archimedes of Syracuse, Eratosthenes, Apollónios, Claudios Ptolemy, Diophantos.
Arabic mathematics and its relation to medieval European mathematics.
The origins of modern mathematics. The search for the roots of polynomial equations. The origins of analytic geometry. Probability. Infinitesimal calculus. Number theory. Non-Euclidean geometry. The origin of set theory.
Development of mathematical symbolism.

Selected topics in school mathematics from the perspective of the history of mathematics.

Recommended literature:

Burton, D. M.: The History of Mathematics: An Introduction. McGraw−Hill, 2007.
Devlin, K.: Jazyk matematiky. Dokořán, 2002. (in czech)
Čižmár, J . Dejiny matematiky (Od najstarších čias po takmer súčasnosť) Perfekt, 2017. (in slovak)
Mareš , M . Příběhy matematiky. Pistorius, 2011. (in czech)

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 169

A	B	C	D	E	FX
68.64	15.98	6.51	4.14	2.37	2.37

Provides: doc. RNDr. Ingrid Semanišinová, PhD.

Date of last modification: 24.08.2022

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ SHMb/22	**Course name:** Seminar on history of mathematics II

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

Number of ECTS credits: 2

Recommended semester/trimester of the course: 3.

Course level: I., II.

Prerequisities:

Conditions for course completion:
Conditions for continuous evaluation:
1. Participation in teaching in accordance with the study rules and instructions of the teacher.
2. Activity.
3. Homeworks.
4. Seminar work on the selected topic and its presentation at the seminar
Conditions for successful completion of the course:
1. Participation in teaching in accordance with the study regulations and according to the instructions of the teacher;
2. Credits will be awarded to students who score at least 50% on homework assignments and tests. Additional points can be achieved for the presentation of a seminar paper.

Learning outcomes:
Students will demonstrate an understanding of the history of the development of some mathematical disciplines and selected concepts. They will demonstrate this understanding by scoring at least 50% on previous topics and homework assignments.

Brief outline of the course:
1. Algebra and geometry of 16th and 17th century - Tartaglia, Vieta, Descartes
2. Beginning of modern number theory - Mersenne, Fermat
3. Development of infinitesimals -- Newton, Leibniz, Bernoulliovci
4. Complex and hypercomplex numbers -- Hamilton, Cayley, Clifford
5. Combinatory and probability - Pascal, Fermat
6. Algebra in the 18th and 19th century - Gauss, Abel, Galois
7. Non-Euclidean geometries - Gauss, Lobačevskij, Bolyai
8. Mathematical analysis in the 19th century - Cauchy, Bolzano, Weierstrass
9. Set theory - Bolzano, Cantor, Zermelo, Franklin
10. Mathematics in the beginning of 20th century - Peano, Hilbert, Gödel

Recommended literature:
Berlinghoff, W.P., Gouvea, F.Q.: Math through the Ages, MAA Press, 2015.
Čižmár, J . Dejiny matematiky (Od najstarších čias po takmer súčasnosť) Perfekt, 2017.
Hairer, E., Wanner, G.: Analysis by its History, Springer, 2008.

Mareš , M . Příběhy matematiky. Pistorius, 2011.

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 29

A	B	C	D	E	FX
51.72	31.03	13.79	3.45	0.0	0.0

Provides: prof. RNDr. Ondrej Hutník, PhD.

Date of last modification: 21.09.2023

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚTVŠ/ TVa/11	**Course name:** Sports Activities I.

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

Number of ECTS credits: 2

Recommended semester/trimester of the course: 1.

Course level: I., II., P

Prerequisities:

Conditions for course completion:
Min. 80% of active participation in classes.

Learning outcomes:
Sports activities in all their forms prepare university students for their professional and personal life. They have a great impact on physical fitness and performance. Specialization in sports activities enables students to strengthen their relationship towards the selected sport in which they also improve.

Brief outline of the course:
Brief outline of the course:
The Institute of physical education and sport at the Pavol Jozef Šafárik University offers 20 sports activities aerobics; aikido, basketball, badminton, body-balance, body form, bouldering, floorball, yoga, power yoga, pilates, swimming, fitness, indoor football, SM system, step aerobics, table tennis, chess, volleyball, tabata, cycling.
Additionally, the Institute of physical education and sport at the Pavol Jozef Šafárik University offers winter courses (ski course, survival) and summer courses (aerobics by the sea, rafting on the Tisza River) with an attractive programme, sports competitions with national and international participation.

Recommended literature:
BENCE, M. et al. 2005. Plávanie. Banská Bystrica: FHV UMB. 198s. ISBN 80-8083-140-8. [online] Dostupné na: https://www.ff.umb.sk/app/cmsFile.php?disposition=a&ID=571
BUZKOVÁ, K. 2006. Fitness jóga, harmonické cvičení těla I duše. Praha: Grada. ISBN 8024715252.
JARKOVSKÁ, H, JARKOVSKÁ, M. 2005. Posilování s vlastním tělem 417 krát jinak. Praha: Grada. ISBN 9788024757308.
KAČÁNI, L. 2002. Futbal:Tréning hrou. Bratislava: Peter Mačura – PEEM. 278s. ISBN 8089197027.
KRESTA, J. 2009. Futsal.Praha: Grada Publishing, a.s. 112s. ISBN 9788024725345.
LAWRENCE, G. 2019. Power jóga nejen pro sportovce. Brno: CPress. ISBN 9788026427902.
SNER, Wolfgang. 2004. Posilování ve fitness. České Budějovice: Kopp. ISBN 8072322141.

STACKEOVÁ, D. 2014. Fitness programy z pohledu kinantropologie. Praha: Galén. ISBN 9788074921155.
VOMÁČKO, S. BOŠTÍKOVÁ, S. 2003. Lezení na umělých stěnách. Praha: Grada. 129s. ISBN 8024721743.

Course language:
Slovak language

Notes:

Course assessment
Total number of assessed students: 15781

abs	abs-A	abs-B	abs-C	abs-D	abs-E	n	neabs
85.74	0.06	0.0	0.0	0.0	0.04	9.0	5.15

Provides: Mgr. Patrik Berta, Mgr. Agata Dorota Horbacz, PhD., Mgr. Dávid Kaško, PhD., Mgr. Ladislav Kručanica, PhD., Mgr. Richard Melichar, Mgr. Petra Tomková, PhD., Mgr. Marcel Čurgali, Mgr. Alena Buková, PhD., univerzitná docentka, doc. PaedDr. Ivan Uher, MPH, PhD., prof. RNDr. Stanislav Vokál, DrSc., Mgr. Zuzana Küchelová, PhD., Mgr. Ferdinand Salonna, PhD.

Date of last modification: 07.02.2024

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚTVŠ/ TVb/11	**Course name:** Sports Activities II.

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

Number of ECTS credits: 2

Recommended semester/trimester of the course: 2.

Course level: I., II., P

Prerequisities:

Conditions for course completion:
active participation in classes - min. 80%.

Learning outcomes:
Sports activities in all their forms prepare university students for their professional and personal life. They have a great impact on physical fitness and performance. Specialization in sports activities enables students to strengthen their relationship towards the selected sport in which they also improve.

Brief outline of the course:
Brief outline of the course:
The Institute of physical education and sport at the Pavol Jozef Šafárik University offers 20 sports activities aerobics; aikido, basketball, badminton, body-balance, body form, bouldering, floorball, yoga, power yoga, pilates, swimming, fitness, indoor football, SM system, step aerobics, table tennis, chess, volleyball, tabata, cycling.
Additionally, the Institute of physical education and sport at the Pavol Jozef Šafárik University offers winter courses (ski course, survival) and summer courses (aerobics by the sea, rafting on the Tisza River) with an attractive programme, sports competitions with national and international participation.

Recommended literature:
BENCE, M. et al. 2005. Plávanie. Banská Bystrica: FHV UMB. 198s. ISBN 80-8083-140-8. [online] Dostupné na: https://www.ff.umb.sk/app/cmsFile.php?disposition=a&ID=571
BUZKOVÁ, K. 2006. Fitness jóga, harmonické cvičení těla I duše. Praha: Grada. ISBN 8024715252.
JARKOVSKÁ, H, JARKOVSKÁ, M. 2005. Posilování s vlastním tělem 417 krát jinak. Praha: Grada. ISBN 9788024757308.
KAČÁNI, L. 2002. Futbal:Tréning hrou. Bratislava: Peter Mačura – PEEM. 278s. ISBN 8089197027.
KRESTA, J. 2009. Futsal.Praha: Grada Publishing, a.s. 112s. ISBN 9788024725345.
LAWRENCE, G. 2019. Power jóga nejen pro sportovce. Brno: CPress. ISBN 9788026427902.
SNER, Wolfgang. 2004. Posilování ve fitness. České Budějovice: Kopp. ISBN 8072322141.

STACKEOVÁ, D. 2014. Fitness programy z pohledu kinantropologie. Praha: Galén. ISBN 9788074921155.
VOMÁČKO, S. BOŠTÍKOVÁ, S. 2003. Lezení na umělých stěnách. Praha: Grada. 129s. ISBN 8024721743.

Course language:
Slovak language

Notes:

Course assessment
Total number of assessed students: 13802

abs	abs-A	abs-B	abs-C	abs-D	abs-E	n	neabs
83.85	0.49	0.01	0.0	0.0	0.04	11.17	4.43

Provides: Mgr. Agata Dorota Horbacz, PhD., Mgr. Dávid Kaško, PhD., Mgr. Marcel Čurgali, Mgr. Patrik Berta, Mgr. Ladislav Kručanica, PhD., Mgr. Richard Melichar, Mgr. Petra Tomková, PhD., Mgr. Alena Buková, PhD., univerzitná docentka, doc. PaedDr. Ivan Uher, MPH, PhD., prof. RNDr. Stanislav Vokál, DrSc., Mgr. Zuzana Küchelová, PhD., Mgr. Ferdinand Salonna, PhD.

Date of last modification: 07.02.2024

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚTVŠ/ TVc/11	**Course name:** Sports Activities III.

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

Number of ECTS credits: 2

Recommended semester/trimester of the course: 3.

Course level: I., II.

Prerequisities:

Conditions for course completion:
min. 80% of active participation in classes

Learning outcomes:
Sports activities in all their forms prepare university students for their professional and personal life. They have a great impact on physical fitness and performance. Specialization in sports activities enables students to strengthen their relationship towards the selected sport in which they also improve.

Brief outline of the course:
Brief outline of the course:
The Institute of physical education and sport at the Pavol Jozef Šafárik University offers 20 sports activities aerobics; aikido, basketball, badminton, body-balance, body form, bouldering, floorball, yoga, power yoga, pilates, swimming, fitness, indoor football, SM system, step aerobics, table tennis, chess, volleyball, tabata, cycling.
Additionally, the Institute of physical education and sport at the Pavol Jozef Šafárik University offers winter courses (ski course, survival) and summer courses (aerobics by the sea, rafting on the Tisza River) with an attractive programme, sports competitions with national and international participation.

Recommended literature:
BENCE, M. et al. 2005. Plávanie. Banská Bystrica: FHV UMB. 198s. ISBN 80-8083-140-8. [online] Dostupné na: https://www.ff.umb.sk/app/cmsFile.php?disposition=a&ID=571
BUZKOVÁ, K. 2006. Fitness jóga, harmonické cvičení těla I duše. Praha: Grada. ISBN 8024715252.
JARKOVSKÁ, H, JARKOVSKÁ, M. 2005. Posilování s vlastním tělem 417 krát jinak. Praha: Grada. ISBN 9788024757308.
KAČÁNI, L. 2002. Futbal:Tréning hrou. Bratislava: Peter Mačura – PEEM. 278s. ISBN 8089197027.
KRESTA, J. 2009. Futsal.Praha: Grada Publishing, a.s. 112s. ISBN 9788024725345.
LAWRENCE, G. 2019. Power jóga nejen pro sportovce. Brno: CPress. ISBN 9788026427902.
SNER, Wolfgang. 2004. Posilování ve fitness. České Budějovice: Kopp. ISBN 8072322141.

STACKEOVÁ, D. 2014. Fitness programy z pohledu kinantropologie. Praha: Galén. ISBN 9788074921155.
VOMÁČKO, S. BOŠTÍKOVÁ, S. 2003. Lezení na umělých stěnách. Praha: Grada. 129s. ISBN 8024721743.

Course language:
Slovak language

Notes:

Course assessment
Total number of assessed students: 9334

abs	abs-A	abs-B	abs-C	abs-D	abs-E	n	neabs
87.96	0.06	0.01	0.0	0.0	0.02	4.92	7.03

Provides: Mgr. Marcel Čurgali, Mgr. Agata Dorota Horbacz, PhD., Mgr. Dávid Kaško, PhD., Mgr. Patrik Berta, Mgr. Ladislav Kručanica, PhD., Mgr. Richard Melichar, Mgr. Petra Tomková, PhD., Mgr. Alena Buková, PhD., univerzitná docentka, doc. PaedDr. Ivan Uher, MPH, PhD., prof. RNDr. Stanislav Vokál, DrSc., Mgr. Zuzana Küchelová, PhD., Mgr. Ferdinand Salonna, PhD.

Date of last modification: 07.02.2024

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚTVŠ/ TVd/11	**Course name:** Sports Activities IV.

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

Number of ECTS credits: 2

Recommended semester/trimester of the course: 4.

Course level: I., II.

Prerequisities:

Conditions for course completion:
min. 80% of active participation in classes

Learning outcomes:
Sports activities in all their forms prepare university students for their professional and personal life. They have a great impact on physical fitness and performance. Specialization in sports activities enables students to strengthen their relationship towards the selected sport in which they also improve.

Brief outline of the course:
Brief outline of the course:
The Institute of physical education and sport at the Pavol Jozef Šafárik University offers 20 sports activities aerobics; aikido, basketball, badminton, body-balance, body form, bouldering, floorball, yoga, power yoga, pilates, swimming, fitness, indoor football, SM system, step aerobics, table tennis, chess, volleyball, tabata, cycling.
Additionally, the Institute of physical education and sport at the Pavol Jozef Šafárik University offers winter courses (ski course, survival) and summer courses (aerobics by the sea, rafting on the Tisza River) with an attractive programme, sports competitions with national and international participation.

Recommended literature:
BENCE, M. et al. 2005. Plávanie. Banská Bystrica: FHV UMB. 198s. ISBN 80-8083-140-8. [online] Dostupné na: https://www.ff.umb.sk/app/cmsFile.php?disposition=a&ID=571
BUZKOVÁ, K. 2006. Fitness jóga, harmonické cvičení těla I duše. Praha: Grada. ISBN 8024715252.
JARKOVSKÁ, H, JARKOVSKÁ, M. 2005. Posilování s vlastním tělem 417 krát jinak. Praha: Grada. ISBN 9788024757308.
KAČÁNI, L. 2002. Futbal:Tréning hrou. Bratislava: Peter Mačura – PEEM. 278s. ISBN 8089197027.
KRESTA, J. 2009. Futsal.Praha: Grada Publishing, a.s. 112s. ISBN 9788024725345.
LAWRENCE, G. 2019. Power jóga nejen pro sportovce. Brno: CPress. ISBN 9788026427902.
SNER, Wolfgang. 2004. Posilování ve fitness. České Budějovice: Kopp. ISBN 8072322141.

STACKEOVÁ, D. 2014. Fitness programy z pohledu kinantropologie. Praha: Galén. ISBN 9788074921155.
VOMÁČKO, S. BOŠTÍKOVÁ, S. 2003. Lezení na umělých stěnách. Praha: Grada. 129s. ISBN 8024721743.

Course language:
Slovak language

Notes:

Course assessment
Total number of assessed students: 5846

abs	abs-A	abs-B	abs-C	abs-D	abs-E	n	neabs
82.54	0.27	0.03	0.0	0.0	0.0	8.24	8.91

Provides: Mgr. Marcel Čurgali, Mgr. Agata Dorota Horbacz, PhD., Mgr. Dávid Kaško, PhD., Mgr. Patrik Berta, Mgr. Ladislav Kručanica, PhD., Mgr. Richard Melichar, Mgr. Petra Tomková, PhD., Mgr. Alena Buková, PhD., univerzitná docentka, doc. PaedDr. Ivan Uher, MPH, PhD., prof. RNDr. Stanislav Vokál, DrSc., Mgr. Zuzana Küchelová, PhD., Mgr. Ferdinand Salonna, PhD.

Date of last modification: 07.02.2024

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ NPR/19	**Course name:** Stochastic processes

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

Number of ECTS credits: 6

Recommended semester/trimester of the course: 2.

Course level: II.

Prerequisities:

Conditions for course completion:
Total evaluation based on a written test (30p) + individual project work (30p) and oral exam (40p). At least 50% must be obtained from each part.
Final evaluation: ≥90% A; ≥80% B; ≥70% C; ≥60% D; ≥50% E; <50% FX.

Learning outcomes:
To obtain knowledge of the stationary stochastic processes analysis in time domain and spectral domain.
To study properties of random processes with discrete time (time series) and continuous time and their application in finance.
To obtain skills in time series analysis with software R.

Brief outline of the course:
1.-2. Stationary precess, linear process.
3. Causal and invertible process.
4. Time domain analysis (autocovariance, autocorrelation and partial autocorrelation function).
5. Sample characteristic of time series and their properties.
6.-7. Frequency domain analysis (spectral density and distribution function, periodogram).
8. Prediction of time series.
9. Random processes with continuous time (fundamental concepts).
10. Brownian motion, Itô's process, Itô's lemma and its application.
11.-12. The Black-Scholes formula.

Recommended literature:
1. Brockwell P., Davis R.: Introduction to Time Series and Forecasting, 3rd ed., Springer, New York, 2016
2. Prášková Z.: Základy náhodných procesů II, Karolinum, Praha, 2016 (in Czech)
3. Tsay R.: Analysis of Financial Time Series, 3rd ed., Wiley Interscience, New Jersey, 2010
4. Shumway R., Stoffer D.: Time Series Analysis and Its Applications with R Examples, 5th ed., Springer, New York, 2024
5. Melicherčík I., Olšarová L., Úradníček V.: Kapitoly z finančnej matematiky, Epos, Bratislava, 2005 (in Slovak)
6. Oksendal B.K.: Stochastic Differential Equations, 6th ed., Springer, 2014

Course language:
Slovak

Notes:
The students are required to have basic knowledge about random vectors and their characteristics, conditional distribution, estimation theory and hypothesis testing.

Course assessment
Total number of assessed students: 92

A	B	C	D	E	FX
41.3	20.65	20.65	8.7	5.43	3.26

Provides: doc. RNDr. Martina Hančová, PhD.

Date of last modification: 21.11.2024

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ SEV/10	**Course name:** Structure and Evolution of the Universe

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: 4

Recommended semester/trimester of the course: 2.

Course level: I., II.

Prerequisities:

Conditions for course completion:
To successfully complete the course, the student must demonstrate sufficient understanding of the basic knowledge of the structure and evolution of the universe. Knowledge of the basic properties of stars and methods of their determination, the structure, evolution and energy sources of stars, the structure of matter in the universe and its evolution is required. The condition for obtaining credits is passing a written or oral exam, preparation, and presentation of a semester essay. The credit evaluation of the course considers the following student workload: direct teaching (1 credit), self-study (2 credit) and assessment (1 credits). The minimum threshold for completing the course is to obtain at least 50% of the total score, using the following rating scale: A (90-100%), B (80-89%), C (70-79%), D (60- 69%), E (50-59%), Fx (0-49%).

Learning outcomes:
After completing the lectures, the student will master the basic knowledge about the properties of stars and methods of their determination, structure, evolution and energy sources of stars, the structure of matter in the universe and its evolution. It will also have sufficient physical knowledge and mathematical apparatus to enable independent solving of a wide range of tasks related to space research.

Brief outline of the course:
1. Basic properties of stars and methods of their determination: radiation flux, apparent and absolute magnitude, distances of stars, colors of stars.
2. Temperature of stars, black body radiation, spectra of atoms and molecules, non-thermal radiation.
3. Spectral classifications, luminosity classes, HR diagram, masses of stars.
4. Structure of stars: basic equations of stellar structure, transfer of energy by radiation and convection, production of energy in stars, fusion reactions.
5. Evolution of stars: interstellar matter and formation of stars and stellar systems, Jeans' criterion, protostars.
6. Evolution of stars: main sequence stars, giants, final stages of star evolution - white dwarfs, neutron stars and black holes.
7. Distribution of matter in the universe: Milky Way, its structure, dynamics, and evolution, types of galaxies, quasars, intergalactic matter, local group of galaxies.

8. Clusters and super-clusters of galaxies, large-scale structure of the universe, dark matter, and dark energy.
9. Evolution of the universe: historical development of views on the universe, Olberson's paradox, gravitational paradox, Cosmological principle.
10. Isotropicity and homogeneity of the universe, relic radiation, expansion of the universe. Steady state theory.
11. Relativistic cosmology: cosmological solutions of Einstein's equations, models of the universe and their properties, theory of the expanding universe, the Big Bang, the age of the universe.
12. Origin of the universe: the initial stages of the expansion of the universe, inflationary expansion and nucleogenesis, the formation of galaxies and galaxy clusters.

Recommended literature:

1. Carroll, B. W., Ostlie, D. A., An Introduction to Modern Astrophysics, Addison-Wesley Publishing Company, Reading, Massachusetts, 1996;
2. Contopoulos, D. Kotsakis, Cosmology, the structure and evolution of the Universe, Springer, 1984;
3. Pasachoff, J.M., Filippenko, A., The Cosmos: Astronomy in the New Millennium, Cambridge University Press, 2013;
4. Vanýsek, V., Základy astronomie a astrofyziky, Academia, Praha,1980;
5. Čeman, R., Pittich, E., Vesmír 1 - Slnečná sústava, MAPA Slovakia, Bratislava, 2002;
6. Čeman, R., Pittich, E., Vesmír 2 - Hviezdy - Galaxie, MAPA Slovakia, Bratislava, 2003;

Course language:
Slovak, English

Notes:

Course assessment
Total number of assessed students: 145

A	B	C	D	E	FX
37.24	27.59	13.79	11.72	9.66	0.0

Provides: doc. RNDr. Rudolf Gális, PhD.

Date of last modification: 20.09.2021

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ SVK/10	**Course name:** Students scientific conference

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

Number of ECTS credits: 4

Recommended semester/trimester of the course:

Course level: I., II.

Prerequisities:

Conditions for course completion:

Learning outcomes:
Individual scientific work of students. Publishing of obtained results in a written form and as a public presentation.

Brief outline of the course:

Recommended literature:
With respect to the research problematics (article in journals, books).

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 101

A	B	C	D	E	FX
99.01	0.99	0.0	0.0	0.0	0.0

Provides:

Date of last modification: 01.12.2021

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚTVŠ/ LKSp/13	**Course name:** Summer Course-Rafting of TISA River

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

Number of ECTS credits: 2

Recommended semester/trimester of the course:

Course level: I., II., P

Prerequisities:

Conditions for course completion:
Completion: passed
Condition for successful course completion:
- active participation in line with the study rule of procedure and course guidelines
- effective performance of all tasks: carrying a canoe, entering and exiting a canoe, righting a canoe, paddling

Learning outcomes:
Content standard:
The student demonstrates relevant knowledge and skills in the field, which content is defined in the course syllabus and recommended literature.
Performance standard:
Upon completion of the course students are able to meet the performance standard and:
- implement the acquired knowledge in different situations and practice,
- implement basic skills to manipulate a canoe on a waterway,
- determine the right spot for camping,
- prepare a suitable material and equipment for camping.

Brief outline of the course:
Brief outline of the course:
1. Assessment of difficulty of waterways
2. Safety rules for rafting
3. Setting up a crew
4. Practical skills training using an empty canoe
5. Canoe lifting and carrying
6. Putting the canoe in the water without a shore contact
7. Getting in the canoe
8. Exiting the canoe
9. Taking the canoe out of the water
10. Steering
a) The pry stroke (on fast waterways)
b) The draw stroke

11. Capsizing
12. Commands

Recommended literature:
1. JUNGER, J. et al. Turistika a športy v prírode. Prešov: FHPV PU v Prešove. 2002. ISBN 8080680973.
Internetové zdroje:
1. STEJSKAL, T. Vodná turistika. Prešov: PU v Prešove. 1999.
Dostupné na: https://ulozto.sk/tamhle/UkyxQ2lYF8qh/name/Nahrane-7-5-2021-v-14-46-39#!ZGDjBGR2AQtkAzVkAzLkLJWuLwWxZ2ukBRLjnGqSomICMmOyZN==

Course language:
Slovak language

Notes:

Course assessment
Total number of assessed students: 232

abs	n
36.64	63.36

Provides: Mgr. Dávid Kaško, PhD.

Date of last modification: 29.03.2022

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚTVŠ/ KP/12	**Course name:** Survival Course

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

Number of ECTS credits: 2

Recommended semester/trimester of the course:

Course level: I., II., P

Prerequisities:

Conditions for course completion:
Completion: passed
Condition for successful course completion:
- active participation in line with the study rule of procedure and course guidelines,
- effective performance of all the tasks defined in the course syllabus

Learning outcomes:
Content standard:
The student demonstrates relevant knowledge and skills in the field, which content is defined in the course syllabus and recommended literature.
Performance standard:
Upon completion of the course students are able to meet the performance standard and should:
- acquire knowledge about safe stay and movement in natural environment,
- obtain theoretical knowledge and practical skills to solve extraordinary and demanding situations connected with survival and minimization of damage to health,
- be able to resist and face situations related to overcoming barriers and obstacles in natural environment,
- be able implement the acquired knowledge as an instructor during summer sport camps for children and youth within recreational sport.

Brief outline of the course:
Brief outline of the course:
1. Principles of conduct and safety in the movement in unfamiliar natural environment
2. Preparation and guidance of a hike tour
3. Objective and subjective danger in the mountains
4. Principles of hygiene and prevention of damage to health in extreme conditions
5. Fire building
6. Movement in the unfamiliar terrain, orientation and navigation
7. Shelters
8. Food preparation and water filtering
9. Rappelling, Tyrolian traverse
10. Transport of an injured person, first aid

Recommended literature:

1. JUNGER, J. et al. Turistika a športy v prírode. Prešov: Fakulta humanitných a prírodných vied PU v Prešove. 2002. 267s. ISBN 80-8068-097-3.
2. PAVLÍČEK, J. Člověk v drsné přírodě. 3. vyd. Praha: Práh. 2002. ISBN 8072520598.
3. WISEMAN, J. SAS: příručka jak přežít. Praha: Svojtka & Co. 2004. 566s. ISBN 8072372807.

Course language:
Slovak language

Notes:

Course assessment
Total number of assessed students: 461

abs	n
46.2	53.8

Provides: Mgr. Ladislav Kručanica, PhD.

Date of last modification: 16.05.2023

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ SDP/18	**Course name:** Tax and insurance administration in practice

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

Number of ECTS credits: 5

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

Course level: II.

Prerequisities:

Conditions for course completion:
Elaboration of projects focused on the application of information systems in tax administration and insurance.

Learning outcomes:
To obtain basic informations on Information system development. To learn tax system in Slovak Republic.

Brief outline of the course:
???

Recommended literature:
Booch G., Jacobson I., Rumbaugh J.: The Unified Modeling Language user Guide, Addison-Wesley, 1998
Tax laws of the Slovak Republic

Course language:
Slovak

Notes:
???

Course assessment
Total number of assessed students: 66

A	B	C	D	E	FX
65.15	13.64	16.67	0.0	4.55	0.0

Provides: doc. RNDr. Roman Soták, PhD., RNDr. Pavol Huraj

Date of last modification: 19.04.2022

Approved: prof. RNDr. Katarína Cechlárová, DrSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/TKO/22	**Course name:** Theory of codes

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

Number of ECTS credits: 5

Recommended semester/trimester of the course: 1.

Course level: II.

Prerequisities:

Conditions for course completion:
A student is evaluated according to an oral examination during which he/she answers two questions chosen by him/her at random, one from the group A and one from the group B (both for 50 points at maximum). Evaluation scale: A ... 90-100 p., B ... 80-89 p., C ... 70-79 p., D ... 60-69 p., E ... 50-59 p., FX ... 0-49 p.

Learning outcomes:
A student gets acquainted with basic principles and theoretical bases of text coding and possibilities of their application.

Brief outline of the course:
Monoids. Basic notions of theory of codes. Examples of codes. Important classes of codes. Maximal codes. Submonoids generated by codes. Stable submonoids. Group codes. Free hull of a set of words. Test for recognising codes. Measure of a code. Bernoulli distribution. Dyck code. Complete sets in monoids. Thin codes. Composition of codes. Indecomposable codes.

Recommended literature:
J. Berstel and D. Perrin, Theory of Codes, Academic Press, 1985

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 28

A	B	C	D	E	FX
46.43	17.86	3.57	3.57	17.86	10.71

Provides: Mgr. Martin Vodička, Dr. rer. nat.

Date of last modification: 26.01.2022

Approved: prof. RNDr. Katarína Cechlárová, DrSc.