CONTENT

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: CJP/ PFAJAKA/07	**Course name:** Academic English
Course type, scope and the method: **Course type:** Practice **Recommended course-load (hours):** **Per week:** 2 **Per study period:** 28 **Course method:** present	
Number of ECTS credits: 2	
Recommended semester/trimester of the course:	
Course level: I.	
Prerequisities:	
Conditions for course completion: Active classroom participation, assignments handed in on time, 2 absences tolerated 1 test (13th week), no retake. Presentation on chosen topic Final evaluation- average assessment of test (50%), and presentation (50%). Grading scale: A 93-100%, B 86-92%, C 79-85%, D 72-78%, E 65-71%, FX 64% and less	
Learning outcomes: The development of students´ language skills - reading, writing, listening, speaking, improvement of their linguistic competence - students acquire knowledge of selected phonological, lexical and syntactic aspects, development of pragmatic competence - students can efectively use the language for a given purpose, with focus on Academic English, level B2.	
Brief outline of the course: Formal and informal English Academic English and its specific features Key academic verbs and nouns Linking words in academic writing, writing a paragraph, word-order, topic sentences Word-formation - affixation abstract Selected aspects of English pronunciation, academic vocabulary Selected functional grammar structures - defining, classifying, epressing opinion, cause-effect, paraphrasing	
Recommended literature: Seal B.: Academic Encounters, CUP, 2002 T. Armer :Cambridge English for Scientists, CUP 2011 M. McCarthy M., O´Dell F. - Academic Vocabulary in Use, CUP 2008 Zemach, D.E, Rumisek, L.A: Academic Writing, Macmillan 2005 Olsen, A. : Active Vocabulary, Pearson, 2013 www.bbclearningenglish.com Cambridge Academic Content Dictionary, CUP, 2009	

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

Notes:

Course assessment
Total number of assessed students: 435

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

Provides: Mgr. Viktória Mária Slovenská

Date of last modification: 11.09.2024

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ ALG4a/22	**Course name:** Algebra I for physicists

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

Number of ECTS credits: 5

Recommended semester/trimester of the course: 3.

Course level: I.

Prerequisities:

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

Learning outcomes:
To obtain basic knowledge from linear algebra concerning systems of linear equations. To be able to apply it in concrete excercises.

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

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

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 909

A	B	C	D	E	FX
10.78	12.65	19.69	18.04	27.61	11.22

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

Date of last modification: 16.04.2022

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ALG4b/22	**Course name:** Algebra II for physicists

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

Number of ECTS credits: 5

Recommended semester/trimester of the course: 4.

Course level: I.

Prerequisities: ÚMV/ALG4a/22

Conditions for course completion:
Exam

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

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

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

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 331

A	B	C	D	E	FX
16.31	10.27	13.29	18.43	31.42	10.27

Provides: doc. RNDr. Roman Soták, PhD., Mgr. Martin Vodička, Dr. rer. nat.
Date of last modification: 16.04.2022
Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ ABE/18	**Course name:** Analysis of Biophysical Experiments
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: 6.	
Course level: I.	
Prerequisities:	
Conditions for course completion: Oral exam where the students present theoretical knowledge of topics listed in the course syllabus.	
Learning outcomes: Students will get an overview of the basic knowledge related to data evaluation in biophysical experiments, verification of hypotheses and discrimination between different models. Students will learn the basic tools for experimental data computer processing.	
Brief outline of the course: 1. Simple experimental measurements, physical units, errors and uncertainties, importance of knowing the uncertainties, estimating uncertainties in repeatable experiments, best estimates, discrepancy, comparison of measured and accepted values, comparison of two measured numbers. 2. Checking relationships with a graph, fractional uncertainties, multiplying two measured numbers, uncertainties in direct measurements, the square-root rule for counting experiments, sums and differences, products and quotients, independent uncertainties in a sum, arbitrary functions of one variable, experimental examples. 3. Analysis of random uncertainties, random and systematic errors, the mean and standard deviation, the normal distribution, hystograms and distributions, limiting distributions, the standard deviation as 68% confidence limit, rejection of data, Chauvenet's criterion, weighted averages, experimental examples. 4. Least-squares fitting, linear data: the slope and the constant parameter, uncertainty in the measured data, experimental examples, least-squares fits to other curves e.g. polynomial or exponential functions, multiple regression, calibration curves in biophysics and biochemistry. 5. Covariance and correlation, covariance in error propagation, coefficient of linear correlation, quantitative significance r, autocorrelation, cross-correlation, use of correlation functions in monitoring the dynamics of individual molecules. 6. The binomial distribution, probabilities in dice throwing, definition of the binomial distribution, the Gauss distribution of random errors, testing of hypothesis, the properties of the Poisson distribution, applications, Chi squared testing, degrees of freedom and reduced chi squared, probabilities for chi squared, experimental examples, solutions, using Excel calculations.	

7. Noise sources in biophysical experiments, mechanical noise, electrical noise (thermal noise, shot noise, interference), noise sources in optical imaging experiments, noise characterisctics: color, power spectrum, signal-to-noise ratio, methods for noise reduction and spectral filtration.
8. Computer processing of experimental data (Origin, Igor), the usage of fitting algorithms, statistical analysis, data plotting in graphs, 3D graphs, statistical graphs, figure preparation for publications.
9. Matlab/Octave: a tool for numerical modeling, complex data fitting with shared parameters, examples and applications.
10. Python: simple still complex tool for data analysis, large set of libraries, application examples: polynomial fitting, Fourier transformation, machine learning.
11. Data analysis in the field of spectral data, data smoothing (moving average, Savitzky-Golay filter, Fourier filter), background subtraction (high-order polynomial fitting, rolling ball algorithm, iterative methods), searching for peak position and intensity, complex spectra as a linear combination of simple contributions.
12. Image processing: using Python for image processing, imaging the relevant regions (ROI – region of interest) and firther analysis, binary thresholding, region separation by color, intensity normalization, border detection.

Recommended literature:

1. J.R. Taylor. An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements, University Science Books, 1997.
2. J. Mandel. The Statistical Analysis of Experimental Data, Dover Publications. 1964
3. E.J. Billo. Excel for Chemist, Wiley, 2011

Course language:
Slovak, English.

Notes:

Course assessment
Total number of assessed students: 5

A	B	C	D	E	FX
80.0	20.0	0.0	0.0	0.0	0.0

Provides: doc. Mgr. Gregor Bánó, PhD.

Date of last modification: 22.09.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ BPO/14	Course name: Bachelor Thesis and its Defence

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

Number of ECTS credits: 4

Recommended semester/trimester of the course:

Course level: I.

Prerequisities:

Conditions for course completion:
Required number of credits gained basedon submitting the bachelor thesis.

Learning outcomes:

Brief outline of the course:
Oral presentation of the bachelor's thesis results before the examination committee.
Answering questions from the supervisor and members of the examination committee regarding the topic of the bachelor's thesis.

Recommended literature:

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 74

A	B	C	D	E	FX
86.49	6.76	4.05	2.7	0.0	0.0

Provides:

Date of last modification: 17.03.2025

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚCHV/ BAM1/00	**Course name:** Biochemical Analytical Methods

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: 5.

Course level: I., II.

Prerequisities:

Conditions for course completion:
Absence of a maximum of three exercises.
Exam carried out in writing with at least 51% score.

Learning outcomes:
The student will gain comprehensive information about the methods and approaches that are used in analyzes in the biochemical laboratory.

Brief outline of the course:
1. Introduction to analytical methods in biochemistry
2. Processing and interpretation of results
3. The effectiveness of the chosen system of methods to ensure the required level of analytical reliability
4. Spectral methods for determination of biomacromolecules
5. Spectroscopy
6. Biosensors
7. Enzymes in bioanalytical chemistry
8. Separation methods
9. Electroanalytical methods
10. Immunochemical methods

Recommended literature:
D. J. Holme, H. Peck: Analytical Biochemistry, 1998
S. R. Mikkelsen, E. Cortón: Bioanalytical Chemistry, 2004
V. A. Gault, N. H. McClenaghan: Understanding Bioanalytical Chemistry: Principles and applications, 2009

Course language:
Slovak, English

Notes:
Teaching is carried out in person or, if necessary, remotely using the tool MS Teams, BigBlueButton, etc. The form of teaching is specified by the teacher at the beginning of the semester, updated continuously.

Course assessment
Total number of assessed students: 101

A	B	C	D	E	FX
32.67	18.81	20.79	20.79	6.93	0.0

Provides: doc. RNDr. Rastislav Varhač, PhD.

Date of last modification: 16.11.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚCHV/ PBC2/99	**Course name:** Biochemistry Practical
Course type, scope and the method: **Course type:** Practice **Recommended course-load (hours):** **Per week:** 4 **Per study period:** 56 **Course method:** present	
Number of ECTS credits: 4	
Recommended semester/trimester of the course: 3.	
Course level: I.	
Prerequisities:	

Conditions for course completion:
Active participation with a maximum of one excused absence without the need for compensation. In case of excused absence from two or more practical exercises (e.g. due to illness), the student agrees with the teacher on alternative dates for practice.
Correctly prepared protocols from all completed tasks.
At least 51% of points from each of the written tests.

Learning outcomes:
To allow students to get practical experience in experimental techniques and methods, currently used in a biochemical research: pipetting, titration, UV/VIS spectrophotometry, thin layer chromatography (TLC), gel electrophoresis, isolation of macromolecules and substances from biological materials and their quantitative and qualitative determination.

Brief outline of the course:
1. Biochemistry laboratory safety rules. Basic biochemical laboratory procedures.
2. Qualitative tests for amino acids and proteins.
3. Isolation of casein from milk. Determination of protein concentration by Lowry method.
4. Determination of the iodine number by Yasud method . Soap production. Reactions with soap. Oxidation of unsaturated fatty acids.
5. Saponification number of fats and oils. Qualitative test for cholesterol: Salkowsky reaction.
6. Qualitative tests for carbohydrates. Determination of reducing carbohydrates by the Schoorl's method.
7.Determination of reducing and nonreducing carbohydrates in germinant plants.
8. Time-dependent course of enzyme-catalyzed reaction: digestion of gelatin by trypsine.
9. Determination of catalase activity and the first order rate constant. Effect of pH on alpha-amylase activity.
10. Effect of substrate concentration on initial rate of reaction, determination of Km and Vmax for urease-catalyzed hydrolysis of urea.
11. Isolation of DNA from spleen. Isolation of RNA from yeast. Qualitative tests for DNA and RNA components.
12. Determination of vitamin C concentration by 2,4-dinitrofenylhydrazine. Determination of vitamins A, B1, and C.

13. Final evaluation of students.

Recommended literature:
Sedlák, Varhač, Danko, Paulíková, Podhradský: Praktické cvičenia z biochémie, 2020, https://unibook.upjs.sk/sk/chemia/1411-prakticke-cvicenia-z-biochemie

Course language:
Slovak

Notes:
Teaching is carried out in person.

Course assessment
Total number of assessed students: 984

A	B	C	D	E	FX
57.72	25.91	9.96	4.67	1.52	0.2

Provides: prof. RNDr. Mária Kožurková, CSc., RNDr. Nataša Tomášková, PhD., doc. RNDr. Rastislav Varhač, PhD., RNDr. Danica Sabolová, PhD., univerzitná docentka

Date of last modification: 17.08.2022

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ BCHF1/18	**Course name:** Biochemistry for Physicists I

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: I.

Prerequisities:

Conditions for course completion:

Learning outcomes:

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 16

A	B	C	D	E	FX
31.25	18.75	25.0	6.25	18.75	0.0

Provides: prof. RNDr. Erik Sedlák, DrSc., doc. RNDr. Gabriel Žoldák, DrSc.

Date of last modification: 27.09.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ BCHF2/18	**Course name:** Biochemistry for Physicists II

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.

Prerequisities: ÚFV/BCHF1/18

Conditions for course completion:

Learning outcomes:

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 13

A	B	C	D	E	FX
30.77	23.08	23.08	15.38	7.69	0.0

Provides: prof. RNDr. Erik Sedlák, DrSc., doc. RNDr. Gabriel Žoldák, DrSc.

Date of last modification: 16.12.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚCHV/ BAC1/04	**Course name:** Bioinorganic Chemistry I

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: 3.

Course level: I., II.

Prerequisities:

Conditions for course completion:
Test or seminar works
examination

Learning outcomes:
The basic knowledges about biometal interactions with biomolecules, biomaterials, biominerals, biocatalysis, metals in biology and medicine, metal-based drugs, toxic metals for biosystems and metals in the environment.

Brief outline of the course:
Metalic and non-metalic elements and their roles in biological systems (biometals, bulk biological elements, essential trace elements). Biocoordination compounds, bioligands. Biocatalyzers. Oxygen carriers and oxygen transport proteins. Photochemical process. Catalysis and regulation processes. Calcium biominerals and biomineralization.Toxic metals. Application of knowledge of bioinorganic chemistry in pharmacy, chemotherapy (e.g. platinum complexes in cancer therapy) radiodiagnostics, mineral biotechnology, ecology and in other branches of life.

Recommended literature:
1. Shriver D. F., Atkins P. W., Overton T. L., Rourke J.P., Weller M.T., Amstrong F.A.: Shiver & Atkins. Inorganic Chemistry. Oxford University Press, Oxford 2006.
2. Kaim W., Schwederski B.: Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life. Wiley, Chichester 1998.
3. Wilkins P. C., Wilkins R. G.: Inorganic Chemistry in Biology. OCP, Oxford 1997.

Course language:

Notes:

Course assessment
Total number of assessed students: 386

A	B	C	D	E	FX
41.71	27.72	19.17	5.96	5.18	0.26

Provides: prof. RNDr. Zuzana Vargová, Ph.D.

Date of last modification: 28.10.2021
Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/BSIM1/14 | **Course name:** Biomolecular Simulations

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

Number of ECTS credits: 5

Recommended semester/trimester of the course: 6.

Course level: I., II.

Prerequisities:

Conditions for course completion:
Elaboration and presentation of the project on given actual subject. Development of own computer programs on project given at the exercises. Exam. Might be substituted by written exam including Q/A part.

Learning outcomes:
Introduction to actual problematics of biomolecular simulations.

Brief outline of the course:
Structural characteristics of biological polymers. Foldamers. Central dogma of molecular biology as flow of biological information. 3D-structure and function of foldamers. Recent view on enzyme mechanisms. Experimental methods of structure determination and their limitations. Empirical force fields and methods of classical molecular dynamics. Molecular dynamics and Monte Carlo methods - algorithms and paralelization. <i>Ab initio</i> molecular dynamics and hybrid approaches. Computational challenges in biomolecular simulations - simulations of chemical reactions, free energy evaluation, protein folding. Computational complexity, nontraditional approaches and heuristic approaches.

Recommended literature:
Actual literature recommended by lecturer.

Course language:

Notes:

Course assessment
Total number of assessed students: 61

A	B	C	D	E	FX
77.05	6.56	13.11	1.64	1.64	0.0

Provides: doc. RNDr. Jozef Uličný, CSc.

Date of last modification: 27.03.2020

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/BFSb1/18 | **Course name:** Biophysical Seminary I

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

Number of ECTS credits: 1

Recommended semester/trimester of the course: 3.

Course level: I.

Prerequisities:

Conditions for course completion:
Independent individual work on the thesis, active participation on seminars. Final diploma thesis.

Learning outcomes:
Completing this seminar, the students should be able to independently elaborate diploma thesis and in comprehensive way communicate the obtained results of their scientific work.

Brief outline of the course:
Seminar on selected topics from biophysical research and topics related to the final theses of the students.

Recommended literature:
The literature will be recommended by supervisors of the theses.

Course language:
English language

Notes:

Course assessment
Total number of assessed students: 11

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

Provides: prof. Mgr. Daniel Jancura, PhD.

Date of last modification: 12.07.2022

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ BFSb2/18	**Course name:** Biophysical Seminary II

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

Number of ECTS credits: 1

Recommended semester/trimester of the course: 4.

Course level: I.

Prerequisities:

Conditions for course completion:

Learning outcomes:

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 7

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

Provides: prof. Mgr. Daniel Jancura, PhD.

Date of last modification: 12.07.2022

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ BSSBF/18	**Course name:** Biophysics

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

Number of ECTS credits: 4

Recommended semester/trimester of the course:

Course level: I.

Prerequisities: ÚFV/MBF1/14 and ÚFV/FCH1/02 and ÚFV/BFB1/14 and ÚFV/EMBF1/18 and ÚFV/EMBF2/18 and ÚFV/EMBF3/18

Conditions for course completion:

Learning outcomes:

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 6

A	B	C	D	E	FX
33.33	50.0	16.67	0.0	0.0	0.0

Provides:

Date of last modification: 15.12.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ BFBB/18	**Course name:** Biophysics in Biomedicine and Biotechnologies
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: 2.	
Course level: I.	
Prerequisities:	
Conditions for course completion: Elaboration of a written essay on a tpoic related to the application of biophysics in biomedicine and biotechnologies.	
Learning outcomes: This course will provide an opportunity for students to obtain knowledge about the utility of biophysics in biomedical research and the application in biotechnology progress. Completing this course, the students should be able to evaluate importance of biophysics for development of biomedical and biotechnology industry.	
Brief outline of the course: Week 1 Ion channels in personalized medicine. Basic knowledge about the structure and function of ion channels in cells. The relationship between the development of various diseases (cardiovascular, neurodegenerative, tumor) and ion channels. Ion channels as tools for drug development. Ion channels as targets for targeted therapy. Week 2 Trans-disciplinary research - workflow for the identification of antivirals (high-throughput X-ray crystallography of complexes, modeling, epitopes, in vitro essays, and the role of XBI). MicroCT with ROI for the study of the pathology of Covid-19-induced lung neovascularization. Experimental monitoring of non-equilibrium structural dynamics - photosynthetic reaction centers, opsins, photolysis of water for hydrogen energy. Week 3 Application of NiR photobiostimulation in the therapy of neurodegenerative diseases - the principle of photobiostimulation, cell chromophores, application of NiR photobiostimulation in the treatment of Alzheimer's disease and Parkinson's disease Week 4 In vitro evolution of proteins. Evolutionary techniques in the development of proteins / enzymes with new properties - interconnection of the methods of biophysics, bioinformatics, biochemistry and molecular biology. Design of mutations by methods of bioinformatics and molecular biology, selection and evolution by methods of molecular biology, analysis of properties - solubility, stability,	

activity - of newly developed proteins by the methods of biochemistry and biophysics. Importance and application of proteins / enzymes with improved properties.
Week 5
Carcinogenesis as an evolutionary process. According to current knowledge, cancer is the result of somatic mutations and epigenetic changes (epimutations), by which cells acquire new properties affecting the ratio between proliferation and apoptosis of individual cells, represented by the so-called the fitness of individual cells depending on the particular environment, which creates a selection pressure on the cells. Because cell properties are inherited during replication, all prerequisites for evolution are met and carcinogenesis can be studied and modeled as an evolutionary process.
Week 6
Lab-on-chip technology. Microfluidic systems. Light-controlled microrobots. Two-photon polymerization of microstructures. Construction of experimental facilities. Time-resolved laser spectroscopy of photosensitive drugs (phosphorescence, fluorescence, transient absorption). Singlet oxygen detection.
Week 7
Biophysical methods for the study of monoclonal antibodies and other therapeutic proteins. Biological function of antibodies, primary and secondary immune response, classes and subclasses of antibodies, role of individual types of antibodies, primary, secondary, tertiary and quaternary structure of antibodies, examples of therapeutic antibodies: trastuzumab and adalimumab. Preparation of antibodies, overview of monitored physicochemical properties of antibodies, critical quality attributes.
Week 8
Application of bioinformatics in biomedicine. The development of new technologies has provided us with an astonishing amount of information about the human gene, including individual differences. In addition to the natural need for database storage of information obtained in this way, there exists also a need to conceptualize procedures, analyzes and data processing in order to understand, model and address complex challenges such as pharmacogenetics and personalized medicine.
Week 9
Mitochondria in diseases and aging. The force of proton motion and the origin of life. Importance of cellular respiration for multicellular organisms. Mitochondria and the origin of the complexity of life. Mitochondrial aging theory. Mitochondria and diseases - origin, course and therapy.
Week 10
Optical imaging, diagnostics and therapy in medicine. Modern trends in optical imaging methods (fluorescence and Raman imaging). Diagnosis and therapy (interaction of light with biological tissues, selected methods of medical optical diagnostics and therapy).
Weeks 11 and 12
Individual study of the selected texts about the applications of biophysics in biomedicine and biotechnologies.

Recommended literature:

1. E. Schrödinger. Whar is life? Cambridge University Press, 1992.
2. T. Hülswitt a R. Brinzanik. Budeme žít věčne? Kniha Zlín , 2012
3. J. Dowsett, P.A. Kenny a R.E. Johnston. The physics of diagnostic imaging. Hodder Arnold, 2006.
4. M.A. Hamblin a P. Mroz. Advances in photodynamic therapy.Artech House, 2008.
5. Súbor aktuálnych vedeckých publikácií

Course language:

English language

Notes:

Course assessment
Total number of assessed students: 16

A	B	C	D	E	FX
93.75	6.25	0.0	0.0	0.0	0.0

Provides: doc. RNDr. Katarína Štroffeková, PhD., doc. RNDr. Jozef Uličný, CSc., prof. Mgr. Daniel Jancura, PhD., RNDr. Branislav Brutovský, CSc., doc. Mgr. Gregor Bánó, PhD., RNDr. Gabriela Fabriciová, PhD., prof. RNDr. Erik Sedlák, DrSc., prof. RNDr. Pavol Miškovský, DrSc.

Date of last modification: 12.07.2022

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚBEV/ BS1/03	**Course name:** Biostatistics
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: 3., 5.	
Course level: I.	
Prerequisities:	
Conditions for course completion: Active participation on practicals, including successful solving of the assigned numerical examples. Passing the continual testing. To absolve the final written test with at least 50% of the maximal score.	
Learning outcomes: To provide the students with knowledge on basic principles of statistic methods used in biology and their scope of application in statistical evaluation of experimental results, and with the principles of the design of experiments, as well.	
Brief outline of the course: 1. Sources and theoretical background of biostatistics. 2.Basic principles of the probability theory. Descriptive statistics: variables, measures of mean value and variability of data. 3. Theoretical and empirical distributions. Experimental sampling from the normal distribution. 4. Reliability of estimations. Testing of hypotheses. I.-. and II.-type errors. 5. Statistical sampling. Comparison of two groups. 6. One-way and multiple analysis of variance. Tests for multiple comparisons. 7. Regression analysis. 8. Correlations. 9. Non-parametrical methods. 10. Design and planning of biological experiments. 11. Aanalysis of time series. 12. Analysis of qualitative data. 13. One- and multidimensional methods, use of computer software.	
Recommended literature: Hassard, T. H.: Understanding biostatistics. Mosby Year Book, 1991 Snedecor,G.W., Cochran,W.G.: Statistical methods. The Iowa state university, Ames, 1972. R.Forthofer, E.S.Lee, M.Hernandez: Biostatistics. A guide to design, analysis and dicovery. Elsevier, Amsterdam, 2007	
Course language:	

Notes:

Course assessment
Total number of assessed students: 294

A	B	C	D	E	FX
4.42	9.18	19.73	25.17	32.65	8.84

Provides: RNDr. Ivana Ihnatová, PhD.

Date of last modification: 21.10.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ BFB1/14	**Course name:** Cell Biophysics I

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: 4

Recommended semester/trimester of the course: 5.

Course level: I.

Prerequisities:

Conditions for course completion:

Learning outcomes:

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 35

A	B	C	D	E	FX
42.86	22.86	17.14	17.14	0.0	0.0

Provides: doc. RNDr. Katarína Štroffeková, PhD., RNDr. Gabriela Fabriciová, PhD.

Date of last modification: 18.09.2023

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

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

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

Number of ECTS credits: 2

Recommended semester/trimester of the course:

Course level: I.

Prerequisities:

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

Learning outcomes:

Brief outline of the course:

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

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

Notes:

Course assessment
Total number of assessed students: 303

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

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

Date of last modification: 06.02.2025
Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: CJP/ PFAJGA/07	**Course name:** Communicative Grammar in English
Course type, scope and the method: **Course type:** Practice **Recommended course-load (hours):** **Per week:** 2 **Per study period:** 28 **Course method:** present	
Number of ECTS credits: 2	
Recommended semester/trimester of the course:	
Course level: I.	
Prerequisities:	
Conditions for course completion: Active classroom participation (maximum 2 absences tolerated), homework assignments completed by given deadlines. Presentation of a topic related to the study field. Final Test - end of semester, no retake Final assessment = average of test and presentation. Grading scale: A 93-100%, B 86-92%, C 79-85%, D 72-78%, E 65-71%, FX 64% and less	
Learning outcomes: The development of students´ language skills - reading, writing, listening, speaking, improvement of their communicative linguistic competence. Students acquire knowledge of selected phonological, lexical and syntactic aspects, development of pragmatic competence. Students can efectively use the language for a given purpose, with focus on Academic English and English on level B2.	
Brief outline of the course: Selected aspects of English grammar and pronunciation Word formation Contrast of tenses in English The passive voice Types of Conditionals Phrasal verbs and English idioms Words order and collocations, prepositional phrases	
Recommended literature: Vince M.: Macmillan Grammar in Context, Macmillan, 2008 McCarthy, O'Dell: English Vocabulary in Use, CUP, 1994 www.linguahouse.com esllibrary.com bbclearningenglish.com ted.com/talks	
Course language:	

English language, level B2 according to CEFR.

Notes:

Course assessment
Total number of assessed students: 446

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

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

Date of last modification: 08.02.2025

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

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

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

Number of ECTS credits: 2

Recommended semester/trimester of the course:

Course level: I.

Prerequisities:

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

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

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

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

Course language:
German, Slovak language

Notes:

Course assessment
Total number of assessed students: 58

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

Provides: Mgr. Ulrika Strömplová, PhD.

Date of last modification: 13.08.2024

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ POF1a/99	**Course name:** Computational Physics I

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

Number of ECTS credits: 4

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

Course level: I., II.

Prerequisities: ÚFV/NUM/10

Conditions for course completion:
To successfully complete the course, the student must demonstrate a sufficient degree of understanding of the principles of computer solution of some typical physical problems. The basis of continuous assessment is participation and activity in exercises and work on assignments. The course ends with a final oral exam, the completion of which is conditional on the submission of all four assignments (projects) electronically and with the attached computer program. The credit evaluation of the course takes into account the following student workload: direct teaching (2 credits) and individual work on projects (2 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%), F (0-49%).

Learning outcomes:
To teach the basic principles of computer solution of some typical physical problems. The course covers both the area of deterministic methods for solving problems by ordinary and partial differential equations as well as the area of stochastic Monte Carlo simulations and thus forms the basis for further study of more advanced computer methods contained in the follow-up course Computational Physics II.

Brief outline of the course:
1. Introduction to dynamical systems.
2. Numerical solution of systems of ordinary differential equations with initial condition.
3. Euler's method, convergence, error estimation and order of the method. One-step methods, Tylor-type and Runge-Kuta (RK2, RK4) methods.
4. Multistep methods, general linear method (explicit, implicit). Methods based on numerical quadrature.
5. Boundary value problems for ordinary differential equations.
6. Numerical solution of partial differential equations (PDE). Difference methods, their consistence, convergence and stability. Elliptic PDE.
7. Parabolic PDE, diffusion equation. Explicit and implicit methods.
8. Introduction to the Monte Carlo method. Monte Carlo integration and application in statistical physics.

9. Basics of probability theory. Monte Carlo estimate of mean and standard deviation. Central theorem of Monte Carlo sampling.
10. Simple and importance sampling. Markov chain. Perron-Frobenius theorem. Metropolis algorithm, detailed balance condition.
11. Monte Carlo simulations of lattice spin systems - application to Ising model.
12. Statistical analysis of Monte Carlo data.

Recommended literature:

Basic literature:

POZRIKIDIS, C.: Num. Comp. in Science and Engineering, Oxford Univ. Press, 2008.
GARCIA A.L.: Numerical Methods for Physics, Prentice-Hall, 1994.
LANDAU D.P., BINDER K.: A Guide to Monte Carlo Simulations in Statistical Physics, Cambridge Univ. Press, 5-th edition, 2021.

Other literature:

BERG, B.A.: Introduction to Markov Chain Monte Carlo Simulations and Their Statistical Analysis (http://www.worldscibooks.com/etextbook/5904/5904_intro.pdf)
JANKE, W.: Monte Carlo Simulations of Spin Systems (http://www.physik.uni-leipzig.de/~janke/Paper/spinmc.pdf)

Course language:

Notes:

Course assessment

Total number of assessed students: 140

A	B	C	D	E	FX	N	P
29.29	17.86	12.14	14.29	19.29	2.86	0.0	4.29

Provides: prof. RNDr. Milan Žukovič, PhD.

Date of last modification: 14.09.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚBEV/ CYT1/15	**Course name:** Cytology
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: I.	
Prerequisities:	
Conditions for course completion: Practicals graduation (without absence); Two written tests graduation (min. 70 % fruitfulness of each); Oral examination	
Learning outcomes: To provide the students with knowledge of basic principles of cell microscopic and submicroscopic structure and function.	
Brief outline of the course: Lectures: 1.) Cell theory. Cell. 2.) Organization of living systems. 3.) Biological membranes. 4.) Transfer of substances across membranes. 5.) Cell wall of plant cells. 6.) Surface structures of cells. Extracellular matrix. Cell movement. 7.) Intercellular connections. 8.) Cytoskeleton. 9.) Cell nucleus. 10.) Mitochondria and cellular metabolism. 11.) Plastids and vacuoles. 12.) Ribosomes. Endoplasmic reticulum. Golgi apparatus. Lysosomes. 13.) Differentiation, aging and cell death, pathological changes in cells. Exercises: 1.) Safety at work in a cytomorphological laboratory. Conditions for successful completion of exercises. 2.) Basics of optics. Origin and construction of the image with a magnifying glass and a microscope. 3.) Microscopic technique. 4.) Shape and size of cells. 5.) Principle of fluorescence and confocal microscopy. 6.) Control test. Vacuole. 7.) Cytoplasm movement. 8.) Nucleus and nucleolus. 9.) Cytoplasmic membrane. 10.) Osmotic processes. 11.) Cell inclusions. 12.) Cell walls of plant cells. 13.) Cell counting. Control test.	
Recommended literature: K.Kapeller, H.Strakele: Cytomorfológia. Osveta Martin, 1999 M.Babák, J.Šamaj: Cytológia. Univerzita Komenského Bratislava, 2002 Alberts B., Bray D., Johnson A., Lewis J.: Základy buněčné biologie. Espero Publishing, 2003 Campbell N. a Reece J.: Biologie. Computer Press, 2006 Kleban J., Mikeš J., Jendželovská Z., Jendželovský R., Fedoročko P.: Cytológia pracovný zošit na praktické cvičenia, 2018	
Course language:	

Notes:

Course assessment
Total number of assessed students: 1150

A	B	C	D	E	FX
12.26	19.04	28.52	22.52	16.7	0.96

Provides: doc. RNDr. Rastislav Jendželovský, PhD., RNDr. Zuzana Jendželovská, PhD., RNDr. Mgr. Martin Majerník, PhD., RNDr. Viktória Dečmanová, PhD., Mgr. Gabriela Blašková

Date of last modification: 19.02.2024

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: CJP/ PFAJ4/07	**Course name:** English Language of Natural Science

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.

Prerequisities:

Conditions for course completion:
Active participation in class and completed homework assignments. Students are allowed to miss 2 classes at the most
Continuous assessment:
1 credit test taken presumably in weeks 6/7
1 project (quiz on the topic of the student´s field of study) 25% of the continuous assessment
5 LMS quizzes (25% of the continuous assessment)
In order to be admitted to the final exam, a student has to score at least 65 % from the continuous assessment
The exam test results represent 50% of the final grade for the course, continuous assessment results represent the other 50% of the final grade.
The final grade for the course will be calculated as follows:
A 93-100, B 86-92, C 79-85, D 72-78, E 65-71, FX 64 and less.

Learning outcomes:
Enhancement of students' language skills (speaking, writing, reading and listening comprehension) in English for specific and academic purposes and development of students' linguistic competence. Students obtain knowledge of selected phonological, lexical and syntactic aspects of professional English, improve their pragmatic competence - students can effectively use the language for a given purpose, and acquire presentation skills at B2 level (CEFR) with focus on terminology of natural sciences.

Brief outline of the course:
1. Introduction to studying language
2. Selected aspects of scientific language
3. Talking about academic study
4. Discussing science
5. Defining scientific terminology and concepts
6. Expressing cause and effect
7. Describing structures
8. Explaining processes
9. Comparing objects, structures and concepts

10. Talking about problem and solution
11. Referencing authors
12. Giving examples
13. Visual aids and numbers
14. Referencing time and place

Presentation topics related to students´study fields.

Recommended literature:

lms.upjs.sk - e-kurz Odborný anglický jazyk pre prírodné vedy.
Redman, S.: English Vocabulary in Use, Pre-intermetdiate, Intermediate. Cambridge University Press, 2003.
Armer, T.: Cambridge English for Scientists. CUP, 2011.
Wharton J.: Academic Encounters. The Natural World. CUP, 2009.
P. Fitzgerald : English for ICT studies. Garnet Publishing, 2011.
https://worldservice/learningenglish, https://spectator.sme.sk
www.isllibrary.com
linguahouse.com

Course language:

English, level B2 (CEFR)

Notes:

Course assessment

Total number of assessed students: 3246

A	B	C	D	E	FX
38.63	26.31	16.3	9.52	7.18	2.06

Provides: Mgr. Viktória Mária Slovenská

Date of last modification: 06.02.2024

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ ZPU1/03	**Course name:** Essentials of UNIX Programming
Course type, scope and the method: **Course type:** Lecture / Practice **Recommended course-load (hours):** **Per week:** 1 / 2 **Per study period:** 14 / 28 **Course method:** present	
Number of ECTS credits: 4	
Recommended semester/trimester of the course: 2.	
Course level: I.	
Prerequisities:	
Conditions for course completion: monitoring of student's programming skills unsupervised creation of the program to solve the given task at the end	
Learning outcomes: To provide students with basic programming skills necessary for solving problems which require applications of numeric methods, simulation techniques and computer data processing.	
Brief outline of the course: 1st week: Linux Basics: Characteristics. Linux distributions. UNIX/LINUX filesystem. Wildcards (*,?). File ownership and permissions. Command line. Shell. Basic LINUX commands for file management. Manual pages. 2nd week: C programing language. Source code. C language syntax. Structure of C programs. GCC Compiler. Formatted output (printf). Declarations and types of variables. Operator sizeof. Arithmetic operators. Assignement operators. Indexed variables (arrays). Text strings as arrays. 3th week: Control flow. Control structures. Statements and blocks. Increment and decrement operators. Loops "while", "for" and "do ... while". Break and continue statements. Relational and logical operators. Conditional expressions. Syntax of the "switch" statement. 4th week: Functions. Declaration of function. Arguments of functions. Return of values by functions. User defined functions. Scope and lifetime of variables. Storage classes - static and automatic variables. 5th week: Library functions. Header files. Mathematical library (math.h). Basic mathematical functions (cos, sin, exp, log). Generator of random numbers (function rand). Rounded values (rint, round, floor, ceil). Symbolic constants. The C preprocessor: macro substitution, conditional inclusion. Bit operators. 6th week: Pointers and addresses (&). Operator of dereferencing (*). Dynamic memory allocation. Functions for memory allocation and deallocation (malloc, calloc, free). Pointers and function arguments. Formatted input (scanf). Structures and unions. Structure FILE. Formatted writing to/ reading from file (functions fprintf, fcanf). 7th week: Summary.	

8th week: Basics of C++. OOP (Object oriented programming) paradigm. Data abstraction. Class, object. Data encapsulation. Member functions. Public and private parts of class. Difference between class and structures.
9th week: Constructor and destructor. Dynamic allocation and deallocation of memory by operators new and delete. Operator overloading. Polymorfism and inheritance.
10th week: Memory Layout of a Process in Linux. Monitoring of runing processes (commands ps, top). Filesystem /proc. Process priorities and scheduling. Signals. Running, stopping and ending processes in background. Ignoring hangup signal by command nohup. Commands bg, fg, jobs. Delayed start of processes - commands at, atq and atrm.
11th week: The Linux programming Interface. System calls. Process identifier (PID), function getpid. Signals -fundamental concepts. Interprocess communication via signals. Signal mask. Commands "kill" and "raise". Changing signal dispositions. Designing signal handlers, commands signal and sigaction. System data types.
12th week: Time Functions: time a gettimeofday. Time-conversion functions. Structures timeval, timespec and tm. Real vs. CPU time. Sleepers, functions sleep, usleep. Interval timers. Nanosecond timers and sleepers.
13th week: Multithreading (API Pthread). Thread ID. Thread creation and termination. Threads synchronization - mutexes. Communication between threads. Thread signal mask. Thread timers via signals.

Recommended literature:

William E. Shotts, Jr., The Linux Command Line: A Complete Introduction, No Starch Press, 2012
Kernighan, B. W., Ritchie, D. M., C programming language, 2nd edition, Prentice Hall PTR, 1988
Stroustrup, B., The C++ Programming Language, Pearson Education, 2013
Kerrisk, M, The Linux Programming Interface: A Linux and UNIX System Programm ing Handbook, No Starch Press, 2010

Course language:

Notes:

Course assessment
Total number of assessed students: 179

A	B	C	D	E	FX
54.19	18.44	20.11	3.91	3.35	0.0

Provides: RNDr. Branislav Brutovský, CSc.

Date of last modification: 20.09.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ EMBF1/18	**Course name:** Experimental Methods of Biophysics 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: 3	
Recommended semester/trimester of the course: 4.	
Course level: I.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 10

A	B	C	D	E	FX
10.0	30.0	40.0	20.0	0.0	0.0

Provides: RNDr. Zuzana Jurašeková, PhD.	
Date of last modification: 30.03.2022	
Approved: prof. Mgr. Daniel Jancura, PhD.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ EMBF2/18	**Course name:** Experimental Methods of Biophysics 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: 3

Recommended semester/trimester of the course: 4.

Course level: I.

Prerequisities:

Conditions for course completion:

Learning outcomes:

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 11

A	B	C	D	E	FX
45.45	18.18	27.27	9.09	0.0	0.0

Provides: prof. RNDr. Erik Sedlák, DrSc., RNDr. Gabriela Fabriciová, PhD., RNDr. Marián Fabián, CSc.

Date of last modification: 30.11.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ EMBF3/18	**Course name:** Experimental Methods of Biophysics III

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: 5.

Course level: I.

Prerequisities:

Conditions for course completion:
Oral exam where the students present theoretical knowledge of topics listed in the course syllabus.

Learning outcomes:
Students will gain basic knowledge on confocal fluorescence microscopy, time-resolved fluorescence microscopy (FLIM / PLIM), high resolution microscopy, flow cytometry. Students will also learn the methods of optical imaging used in clinical practice, the basics of Lab on chip technology and the principles of building experimental equipment. Students will get a theoretical basis, which they will be able to utilize for the experiments using the listed methods.

Brief outline of the course:
1. Confocal fluorescence microscopy:
Principles of confocal fluorescence microscopy, preparation of samples for vital staining and for immunofluorescence, detection of cell organelles, localization and distribution of proteins in cells, colocalization of dyes, analysis of fluorescence image.
2. Time-resolved fluorescence microscopy (FLIM):
Principle of time-resolved fluorescence microscopy, time and frequency domain FLIM detection, Förster resonance energy transfer (FRET), the influence of the environment on the detection of fluorescent probes, measurement of the level of oxidative stress in cells.
3. Time-resolved phosphorescence microscopy (PLIM):
Principles of time-resolved phosphorescence microscopy, the influence of the environment on the detection of phosphorescent probes, quenching of phosphorescence, detection of temperature changes and oxygenation in cells and tissues. Possibilities of sensor application for detection of oxygen and oxygen deficiency in vitro and in vivo.
4. High resolution microscopy:
Principle of selected microscopic approaches for detection of proteins and molecules in cells at high resolution: structured illumination microscopy (SIM), stimulated emission depletion (STED), photo-activated localization microscopy (PALM), stochastic optical reconstruction microscopy (STORM).
5. Flow cytometry:

Principles of flow cytometry, use of fluorescence in cell counting and subsequent analysis of specific factors, cell cycle, changes caused by oxidative stress, separation of cells based on vital staining and immunolabeling, detection of apoptosis and necrosis in the cell population.
6. Optical imaging techniques used in clinical practice:
Examples of bioimaging through: autofluorescence, second harmonic generation (SHG), fluorescence of clinically approved contrast molecules, optical coherence tomography (OCT).
7. Advanced imaging methods:
Electron microscopy, transmission electron microscope, scanning electron microscope. Atomic force microscopy (AFM).
8. Lab on chip technology:
Advantages of LOC technologies. Overview of microfluidic systems and their applications in molecular and cell biology. Instrumentation and preparation of microfluidic devices.
Development of experimental equipment:
9. Electrical signals:
Excitation and detection of electrical signals. Arbitrary function generator, digital oscilloscope and multimeter, laboratory card. Voltage sources. Weak signal measurements: lock-in amplifier. Shielding and grounding of devices. Basics of PID control.
10. Sources of optical radiation:
Classic sources of optical radiation: gas discharge lamps, fluorescent lamps, light bulbs. LEDs. Pulsed LED emitters. Lasers. Selection of lasers based on laser radiation parameters: wavelength, power, beam quality, polarization. Pulsed laser radiation sources.
11. Detection of optical radiation:
Basic terms, flux, irradiance, light intensity. Optical detectors, photodiodes, avalanche photodiodes, pin diodes, photomultipliers, thermal detectors. CCD cameras, CMOS cameras.
12. Building experimental apparatuses:
Basic principles of planning experimental equipment. Detection sensitivity, noise sources. Mechanical and thermal stability. Overview of optical and optomechanical components.

Recommended literature:

1. Wolfgang Becker: The bh TCSPC Handbook Seventh Edition, Becker & Hickl GmbH 2017;
2. Guy Cox: Optical Imaging Techniques in Cell Biology, Taylor & Frances;
3. Howard M. Shapiro: Practical Flow Cytometry Fourth edition, 2003;
4. Nikolas Long and Wing-Tak Wong: The chemistry of molecular imaging, Wiley 2014

Course language:
Slovak language, English.

Notes:

Course assessment
Total number of assessed students: 9

A	B	C	D	E	FX
66.67	11.11	22.22	0.0	0.0	0.0

Provides: doc. Mgr. Gregor Bánó, PhD., RNDr. Veronika Huntošová, PhD.

Date of last modification: 22.09.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚBEV/ ETB1/99	**Course name:** Experimental techniques in Biology

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

Number of ECTS credits: 4

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

Course level: I.

Prerequisities: ÚBEV/CYT1/15

Conditions for course completion:
active participation on practicals/seminars, exam

Learning outcomes:
To provide the students with the knowledge of basic experimental techniques in biology.

Brief outline of the course:
1. Course management. Laboratory safety.
2. Molecular markers; Polymerase chain reaction (PCR), RT-PCR, Real-Time PCR).
3. Molecular cytology – Flow cytometry – principles and application in cell biology.
4. Work in aseptic conditions (in vitro); work with cell lines – subculturing, staining, cell counting, MTT test.
5. Laboratory animals, strains and inbreed lines; Breeding and manipulation with animals.
6. Manipulation with laboratory animals; Behavioural tests.
7. Animal dissection; Anatomy of animals.
8. Surgery in experimental research.
9. Fluorescence and confocal microscopy in experimental research.
10. Fieldwork; Botanical fieldwork and follow-up laboratory assessment.
11. Use of scientific literature. Presentation of own results.
12. Transgenic organisms in biological research.
13. Conditional Gene Knockout.

Recommended literature:
Zutphen, L. F. M., Baumans, V., Beynen, A. C.: Principles of Laboratory Animal Science. Elsevier, Amsterdam, 1993

Course language:
English for Erasmus students

Notes:

Course assessment
Total number of assessed students: 268

A	B	C	D	E	FX
55.6	13.43	13.06	4.1	12.69	1.12

Provides: RNDr. Ján Košuth, PhD., RNDr. Anna Alexovič Matiašová, PhD., Mgr. Vladislav Kolarčik, PhD., univerzitný docent, doc. RNDr. Juraj Ševc, PhD., doc. RNDr. Rastislav Jendželovský, PhD., RNDr. Natália Pipová, PhD., RNDr. Jana Vargová, PhD.

Date of last modification: 15.10.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚCHV/ VCHU/15	**Course name:** General Chemistry

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

Number of ECTS credits: 7

Recommended semester/trimester of the course: 1.

Course level: I.

Prerequisities: ÚCHV/CHV1/99

Conditions for course completion:
Written test in the middle and the end of the semester followed by the oral examination. Active participation on seminars.

Learning outcomes:
To provide students with knowledge of atoms and molecules their electronic structure, theories of chemical bonds, physical and chemical properties of elements and compounds as well as their periodicity.

Brief outline of the course:
Main terms used in chemistry. Atoms – models of atoms, electron configuration, chemical periodicity and its effect on the properties of elements, radioactivity. Chemical bonds and intermolecular interactions. Chemical structure and physical properties of matter. State of matter. Solutions. Chemical equilibrium. Basis of chemical thermodynamics and chemical kinetics. Classification of chemical reactions. Electrochemistry.

Recommended literature:
1. Atkins P., Jones L.: Chemical Principles, 2nd ed., Freeman, New York 2002.
2. Russel J.B.: General Chemistry, 2nd ed., McGraw Hill, London 1992.

Course language:

Notes:

Course assessment
Total number of assessed students: 413

A	B	C	D	E	FX
24.7	27.36	28.09	12.35	6.78	0.73

Provides: prof. RNDr. Vladimír Zeleňák, DrSc., doc. RNDr. Ivan Potočňák, PhD.

Date of last modification: 07.02.2022

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ VF1a/12	**Course name:** General Physics I

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

Number of ECTS credits: 7

Recommended semester/trimester of the course: 1.

Course level: I.

Prerequisities:

Conditions for course completion:
Terms and conditions of assessment during the semester
-participation in classes in accordance with study regulations and teacher´s instructions
-active participation at seminars and exercises
-submitting all the assignments in accordance with teacher´s instruction
-tests during the semester
-project group work and its successful presentation and defence
Final assessment:
-final oral examination
Conditions for successful completion of the course:
-participation in lessons in accordance with the study regulations and teacher's instructions
-achieving the level higher than 50 % in assessment during the semester and in final assessment

Learning outcomes:
By the end of the course student masters basic knowledge connected with mechanics, molecular physics and thermodynamics. Student will be able to solve various problems connected with the course content and apply gained knowledge in different situations.

Brief outline of the course:
1. Basic knowledge of the calculus, vector algebra. Standards and units.
2. Mechanics of particle.
3. Gravitational field.
4. Work, power and energy.
5. Mechanics of system of particles.
6. Mechanics of rigid body.
7. Mechanics of elastic body.
8. Mechanics of fluids.
9. Basics of molecular physics. Structure and properties of gases.
10. Basics of thermodynamics.
11. Heat transfer. Thermal expansion.
12. Structure and properties of liquids
13. Changes of state.

Recommended literature:
CUMMINGS, Karen, LAWS, Priscilla, REDISH, Edward, COONEY, Patrick: Understanding Physics, John Wiley & Sons, 2004

Course language:
English

Notes:

Course assessment
Total number of assessed students: 373

A	B	C	D	E	FX
23.32	14.48	21.72	14.75	16.62	9.12

Provides: doc. RNDr. Zuzana Ješková, PhD., RNDr. Katarína Kozelková, PhD.

Date of last modification: 15.09.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ VF1b/24	**Course name:** General Physics II
Course type, scope and the method: **Course type:** Lecture / Practice **Recommended course-load (hours):** **Per week:** 4 / 2 **Per study period:** 56 / 28 **Course method:** present	
Number of ECTS credits: 7	
Recommended semester/trimester of the course: 3.	
Course level: I.	
Prerequisities:	

Conditions for course completion:

To successfully complete the course (presence, if necessary distance), the student must demonstrate sufficient understanding of the basic concepts and laws of electromagnetism, so that it is possible to continue the study of general physics III, IV and the discipline of electromagnetic field theory. Knowledge of individual laws of electricity and magnetism and their generalization in the form of Maxwell's equations is required. Knowledge of these laws in nature and in practical use is required. Another requirement is adequate skills in solving the problems of electricity and magnetism.
Credit evaluation takes into account the scope of teaching (4 hours of lectures, 2 hours of numerical exercises, 4 credits), self-study (1 credit), evaluation (2 credits) and the fact that it is a basic subject that is part of the bachelor's state exam.The minimum limit for successful completion of the course is to obtain 50 points from the subsequent point evaluation, while it is necessary to obtain at least 50% of points from each part:
Numerical exercises maximum number of 20 points (usually 2 written tests of 10 points each, the student must obtain at least 5 points from each test)
Oral exam with a maximum of 80 points (answer to three questions, each of which must reach a level of at least 50%).
Rating scale
A 100-91
B 90-81
C 80-71
D 70-61
E 60-50
Fx 49-0

Learning outcomes:

After completing lectures and exercises, the student will have sufficient knowledge of the basics of electricity and magnetism and will be able to solve numerical problems of electromagnetism. He will also gain adequate knowledge about electromagnetic phenomena in nature and the use of electromagnetic phenomena in technical applications.

Brief outline of the course:

1. Week: Electrostatic field in vacuum. Culomb's law. Electric field. Electric dipole. Flux of electric field. Gauss' law.
2. Week: Work of forces in the electrostatic field. Potential. Relationship between electric fiel and electric potential. Potential and its measurement. Capacity of conductor and conductor system. Energy of electrostatic field.
3. Week: Stationary electric field and steady electric current. Ohm's law. Superconductivity. Equation of continuity of electric current. Electrical circuits with steady voltage. Kirchhoff's laws and their application. Work, power, energy and efficiency of the source of electromotive voltage.
4. Week: Electric current in electrolytes, semiconductors, gases and in vacuum. Thermoelectric phenomena and their use.
5. Week: Origin, properties and basic quantities of a stationary magnetic field in vacuum. Biot-Savart law and its application. Magnetic flux density.
6. Week: Interactions of a magnetic field with moving electrically charged particles and with electric currents. Ampere's law. Interaction between current conductors. Definition of ampere as current unit. Lorentz force.
7. Week: Quasi-stationary electric field. Capacitor charging and discharging process (R-C circuit). The phenomenon of electromagnetic induction. Faraday's law. Phenomenon of self-induction and mutual induction, inductance, mutual inductance. Potential of magnetic field.
8. Week: Transient in the R-L circuit. Energy of magnetic field. Energy conservation law. Magnetic dipole. Alternating currents and basic circuits of alternating electric current. RLC circuit
9. Week: Serial and parallel resonance. Multiphase currents. Rotating magnetic field. Formation of multiphase currents. Electric motor. Power of alternating electric current.
10. Week: Electrical phenomena in the material environment. Dielectric polarization, mechanisms. Electric field in dielectric. Interaction of electric charges stored in a dielectric. Gauss' law. Polarization vector and electrical induction vector and their mutual relationship. Linear and nonlinear dielectrics.
11. Week: Magnetic properties of substances. Elementary magnetic field of an atom. Magnetic state of substances. Magnetic polarization. Diamagnetism and paramagnetism. Arranged magnetic structure. Ferromagnets.
12. Week: Unsteady electromagnetic field. Maxwell's equations.

Recommended literature:
T. Matsushita: Electricity and Magnetism, Springer, 2017

Course language:
english

Notes:
Presence form represents a standart form for the course, if a need arises, the course is performed using MS Teams.

Course assessment
Total number of assessed students: 391

A	B	C	D	E	FX
34.78	14.58	16.37	12.28	9.72	12.28

Provides: prof. RNDr. Peter Kollár, DrSc., doc. RNDr. Adriana Zeleňáková, DrSc., doc. RNDr. Erik Čižmár, PhD.

Date of last modification: 21.02.2024

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/VF1c/24	**Course name:** General Physics III

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

Number of ECTS credits: 7

Recommended semester/trimester of the course: 2.

Course level: I.

Prerequisities: ÚFV/VF1a/12

Conditions for course completion:
Written test (2x) from seminars during the semester.
Oral examination.

Learning outcomes:
The objective is to acquaint the students with the basis of oscilations, waves and optics.

Brief outline of the course:
Undamped oscilations, Mathematical, Physical and Torsional pendulum, Damped oscilations, Fourier transformation, Forced oscilations. Waves, their generation, waves equation.Interference. Huyghens principle. Reflection, difraction. Doppler effect. Waves speed in materials. Acoustics. Geometrical optics. Mirrors, lens. Fotometry.
Light as electromagnetic wave. Dispersion, absorption, interference, difraction, polarization. Photon's theory of light. Law of emision and absorption, Planck's law of radiation. Lasers.

Recommended literature:
1. A. Hlavička et al., Fyzika pro pedagogické fakulty, SPN, 1971
2. R.P. Feynman et al., Feynmanove prednášky z Fyziky I,II,III, ALFA, 1985
3. D. Halliday et al.,Fyzika-Vysokoškolská učebnice obecné fyziky, VUTIUM, 2010
4. J. Fuka, B. Havelka, Optika a atómová fyzika, SPN,1961
5. A. Štrba, Všeobecná Fyzika 3 – Optika, ALFA, 1979

Course language:
slovak

Notes:

Course assessment
Total number of assessed students: 41

A	B	C	D	E	FX
29.27	24.39	26.83	14.63	4.88	0.0

Provides: doc. RNDr. Ján Füzer, PhD., RNDr. Samuel Dobák, PhD.

Date of last modification: 21.02.2024

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ VF1d/12	**Course name:** General Physics IV
Course type, scope and the method: **Course type:** Lecture / Practice **Recommended course-load (hours):** **Per week:** 4 / 2 **Per study period:** 56 / 28 **Course method:** present	
Number of ECTS credits: 7	
Recommended semester/trimester of the course: 4., 6.	
Course level: I.	
Prerequisities: ÚFV/VF1c/10 or ÚFV/VF1c/12 or ÚFV/VF1c/22	
Conditions for course completion: - active participation in lectures and excersises - submission of solved tasks - 2x test - an exam Credit evaluation of the subject: direct teaching and consultations (2credits), self-study (1credit), practical activities- solved tasks (2redits), evaluation (2credits), a total of 7credits. Minimum limit for completion of the course is to obtain at least 51% of the total evaluation.	
Learning outcomes: Basic knowledge about the atomic structure and spectra and nuclei, and elementary particles. Basic experimental methods in nuclear physics and passage of nuclear radiation through media.	
Brief outline of the course: 1.-6. week Atomic Physics - A.Kravčáková (P): Corpuscular-wave dualism: De Broglie waves. Experimental confirmation of de Broglie's hypothesis. Uncertainty principle. Atom structure: Atomic hypothesis. Rutherford's experiment. Bohr model of the atom. Hydrogen radiation spectra. Combination principle. Quantum mechanical description of a hydrogen atom. Electron shell: Spectra of hydrogen type atoms. Experimental verification of the existence of discrete levels of atoms (Franck-Hertz experiment). Angulat momentum of electron motion. Stern-Gerlach experiment. Quantum states of electrons. Atoms with more electrons. Alkali metal spectra. Total angular momentum of an atom. Magnetic momentum of an atom. An atom in an external magnetic and electric field. Zeeman's phenomenon. Selection rules. Pauli's principle. Periodic table of elements. X-ray spectra. Molecules: Ion and covalent coupling, spectra of molecules. 7.-12. week Nuclear Physics - J.Vrláková (P): Basic characteristics of atomic nuclei: Mass and electric charge. Radius of the atomic nucleus. Binding energy. Spin and magnetic momentum of the nucleus. Quadrupole momentum. Parity. Nuclear forces and models of atomic nuclei: Properties of nuclear forces. Meson theory of nuclear forces. Models of atomic nuclei (droplet, layer and generalized model).	

Radioactive radiation: Basic laws of radioactive decay. Law of decay. Alpha decay. Beta decay. Processes taking place in the nucleus during beta conversion. Neutrino existence hypothesis. Fermi's theory. Internal conversion. Gamma radiation.
Nuclear reactions: Basic terms and definitions. Classification of nuclear reactions. Conservation laws. Effective cross section. Mechanisms of nuclear reactions. Basic types of reactions. Breit-Wigner formula. Reactions with neutrons. Fission of atomic nuclei. Mechanism of fission. Nuclear reactor. Thermonuclear reactions.
Week 13 Subnuclear physics - A.Kravčáková (P):
Elementary particles: The concept of an elementary particle. Basic characteristics of particles. Conservation laws. Types of interactions. Antiparticles. Classification of elementary particles. Strange particles. Resonances. Quark model of hadrons.
Cosmic radiation: Primary and secondary components. Elementary particles and cosmology.
Week 14 Experimental methods - A.Kravčáková (P):
Passage of radiation through matter: The passage of heavy charged particles, electrons and gamma radiation through the matter.
Detectors: Basic characteristics of detectors. Volt-ampere characteristic. Gas detectors. Ionization chambers and Geiger-Müller computer. Scintillation, Cherenkov and semiconductor detectors. Track detectors.
Particle accelerators: Linear accelerator. Cyclic accelerators. Colliders.

Recommended literature:

1. Beiser A., Úvod do moderní fyziky, Praha, 1975.
2. Úlehla I., Suk M., Trka Z.: Atómy, jádra, částice, Praha, 1990.
3. Síleš E., Martinská G.: Všeobecná fyzika IV, skriptá PF UPJŠ, 2. vydanie, Košice, 1992.
4. Vrláková J., Kravčáková A., Vokál S.: Zbierka príkladov z atómovej a jadrovej fyziky, skriptá PF UPJŠ, Košice, 2016.
5. Hajko V. and team of authors, Physics in experiments, Bratislava, 1997.
6. Nosek D., Jádra a částice (Řešené příklady), Matfyzpress, MFF UK, Praha 2005,
7. Kravčáková A., Vokál S., Vrláková J., Všeobecná fyzika IV, 1.časť Atómová fyzika, skriptá PF UPJŠ, Košice, 2020.
8. Yang F., Hamilton J.H., Modern Atomic and Nuclear Physics, WSC Singapore, 2010.

Course language:
slovak and english

Notes:

Course assessment
Total number of assessed students: 115

A	B	C	D	E	FX
40.87	27.83	13.04	8.7	9.57	0.0

Provides: doc. RNDr. Adela Kravčáková, PhD., doc. RNDr. Janka Vrláková, PhD., RNDr. Zuzana Paulínyová, PhD.

Date of last modification: 16.09.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ UPF1/12	**Course name:** Introduction to Computational Physics

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: 1., 3.

Course level: I.

Prerequisities:

Conditions for course completion:
Elaboration of microreferat on given topics.
Exam and discussion of the implementation of the given project.

Learning outcomes:
The aim of the lecture is to provide students with the physical background of the computational processes in conventional computers, as well as to provide less conventional possibilities to implement computational processes using deeper knowledge of physical processes.

Brief outline of the course:
Physical processes utilised in contemporary computers. Computational processes / thermodynamics point of view. Physical limits of current computer technologies (Moore, Amdahl laws
. Computer modeling and physical reality. Computational complexity and paralelism. Distributed computing. Alternative methods of computation (analogue , optical processors, DNA computing, quantum computing).

Recommended literature:
Actual literature provided by lecturer.

Course language:

Notes:

Course assessment
Total number of assessed students: 51

A	B	C	D	E	FX
86.27	7.84	3.92	0.0	1.96	0.0

Provides: doc. RNDr. Jozef Uličný, CSc.

Date of last modification: 22.09.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice
Faculty: Faculty of Science

Course ID: ÚFV/ UVF/05	**Course name:** Introduction to General Physics

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.

Prerequisities:

Conditions for course completion:
Terms and conditions of assessment during the semester
-participation in classes in accordance with study regulations and teacher´s instructions
-active participation at seminars and exercises
-submitting all the assignments in accordance with teacher´s instruction
-tests during the semester
Final assessment:
-based on assessment during the semester
Conditions for successful completion of the course:
-participation in lessons in accordance with the study regulations and teacher's instructions
-achieving the level higher than 50 % in assessment during the semester and in final assessment

Learning outcomes:
By the end of the course student is able to solve problems connected with mechanics, molecular physics and thermodynamics. In solving problems student is able to apply digital tools for data collection, videomeasurement and computer modelling and data processing and their analysis.

Brief outline of the course:
The course is an auxiliary subject to the course General physics 1 - Mechanics, Molecular Physics and Thermodynamics aimed to development of conceptual understanding and problem solving connected with the following areas:
1. Kinematics and dynamics of motion along a line and two-dimensional motion of particle. Equation of motion.
2. Gravitational field. Projectile motion.
3. Work, power and energy. Law of energy conservation.
4. Rotational motion. Equation of rotational motion.
5. Law of momentum conservation and angular momentum conservation.
6. Deformation. Hook´s law.
7. Fluid mechanics.
8. Gases. Ideal gas laws.
9.Basics of thermodynamics. First law of thermodynamics.
10.Heat and heat exchange.

11. Liquids. Surface tension.
12. Changes of state.

Recommended literature:
CUMMINGS, Karen, LAWS, Priscilla, REDISH, Edward, COONEY, Patrick: Understanding Physics, John Wiley & Sons, 2004

Course language:
English

Notes:

Course assessment
Total number of assessed students: 369

A	B	C	D	E	FX
36.86	20.87	24.39	13.28	4.34	0.27

Provides: doc. RNDr. Zuzana Ješková, PhD., RNDr. Katarína Kozelková, PhD.

Date of last modification: 15.09.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ UVF2/24	**Course name:** Introduction to General Physics 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.

Prerequisities:

Conditions for course completion:
Terms and conditions of assessment during the semester
-participation in classes in accordance with study regulations and teacher´s instructions
-active participation at seminars and exercises
-submitting all the assignments in accordance with teacher´s instruction
-tests during the semester Final assessment:
-based on assessment during the semester
Conditions for successful completion of the course:
-participation in lessons in accordance with the study regulations and teacher's instructions
-achieving the level higher than 50 % in assessment during the semester and in final assessment

Learning outcomes:
By the end of the course student is able to solve problems and explain phemomena and experiments connected with selected areas of Electricity and Magnetism.

Brief outline of the course:
The course is an auxiliary subject to the course General physics 2 - Electricity and Magnetism aimed to development of conceptual understanding and problem solving connected with the following areas:
1. Electric field. Coulomb´s law.
2. Work, electric potential energy, electric potential.
3. Electric capacitance and capacitors.
4. Electric current. Ohm´s law, Kirchhoff´s laws.
5. Work and power. Energy and efficiency of sources of electromotive force
6. Magnetic field.
7. Interaction between magnetic field and electric charge.
8. Transient phenomena in RC circuit.
9. Electromagnetic induction.
10. Transient phenomena in RL circuit.
11. Alternating current circuits.
12. Resonance in series and paralel circuits.

Recommended literature:

Matsushita, Teruo. Electricity and Magnetism, Springer 2017
CUMMINGS, Karen, LAWS, Priscilla, REDISH, Edward, COONEY, Patrick: Understanding Physics, John Wiley & Sons, 2004

Course language:
English

Notes:

Course assessment
Total number of assessed students: 2

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

Provides: doc. RNDr. Zuzana Ješková, PhD.

Date of last modification: 21.02.2024

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ZMF/17	**Course name:** Introduction to Mathematics for Physicists

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

Number of ECTS credits: 3

Recommended semester/trimester of the course: 1.

Course level: I.

Prerequisities:

Conditions for course completion:

Learning outcomes:

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 319

A	B	C	D	E	FX
38.24	20.69	19.12	10.34	8.78	2.82

Provides: RNDr. Tomáš Lučivjanský, PhD., univerzitný docent, doc. RNDr. Jozef Hanč, PhD.

Date of last modification: 16.11.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: Dek. PF UPJŠ/USPV/13 | **Course name:** Introduction to Study of Sciences

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: **Per study period:** 12s / 3d
Course method: present

Number of ECTS credits: 2

Recommended semester/trimester of the course: 1.

Course level: I.

Prerequisities:

Conditions for course completion:

Learning outcomes:

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 2369

abs	n
90.12	9.88

Provides: doc. RNDr. Marián Kireš, PhD.

Date of last modification: 30.08.2022

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

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

Course assessment Total number of assessed students: 520					
A	B	C	D	E	FX
38.08	23.08	23.46	10.96	0.96	3.46

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

Date of last modification: 21.11.2024

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ LTV/18	**Course name:** Laboratory techniques

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.

Prerequisities:

Conditions for course completion:
(1) Test-paper (written exam during the semester - approximately in the 5th week of the semester - at the end of the theoretical-computational part of the course)
(2) Laboratory protocol (laboratory report)

Learning outcomes:
Completing the course student will get knowledge and first experiences of safe and efficient work in biophysical (chemical, optical spectroscopy) laboratory.

Brief outline of the course:
Week 1
Course schedule and requirements for successful completion of the course. Introduction to the fundamentals of laboratory work and safety, chemical and general safety. Introduction and definition, presentation of the laboratories at the Department of Biophysics and Center for Interdisciplinary Biosciences.
Week 2
Composition of substances and solutions: basic characteristics of solutions. Chemical formula and molecular weights, percentage composition from formulas, from empirical formula to molecular formula, mass and mass fraction, molar weight, molar volume, molarity, the concentration of a solution.
Week 3
Mixtures and solutions: solubility of substances, solution and its concentration, mass/volume concentration, the concentration of a solution in %, molar concentration, mole-mass relationships in chemical reactions, concentration units – ppm, ppb.
Week 4
Mixtures and solutions: diluting and mixing solutions.
Week 5
Written exam. Laboratory safety rules and guidelines.
Week 6
Proper and safe use of small laboratory equipment/instruments: automatic pipettes, centrifuge, laboratory dryer, Milli-Q ultrapure water system. Laboratory digester. Care and safe laboratory glassware/material use – handling, cleaning and storing.

Week 7
Preparation of solutions: Analytical balances and proper weighing practices; working safely with solvents, the storage and disposal of chemicals, solvents, stock solutions and chemical waste. What is Parafilm?
Week 8
Preparing buffer solutions. pH determination, acidity and alkalinity. Working principle of pH meter - calibration and working demonstration. Working with acids and bases.
Week 9
Introduction to spectroscopy. The light. Spectroscopic experiment. Spectroscopic techniques. Jablonski diagram. UV-Vis absorption spectrophotometry. Chromophore. Lambert-Beer's law. Absorption spectrum. Absorption spectrophotometer. Fluorescence spectroscopy. Fluorophore. Excitation and emission spectra. Characteristics of fluorescence spectra. Fluorescence quenching.
Week 10
Introduction to spectrophotometry: working with spectroscopic equipment - preparation of solutions of selected molecules at different pH and measurement of their UV-Vis absorption spectra.
Week 11
Introduction to spectrophotometry: working with spectroscopic equipment - measurement of fluorescence spectra of the selected molecules at different pH.
Week 12/13
Data collection, processing and analysis. Preparing a Practical/Scientific laboratory report. Evaluation of Laboratory reports.
Keeping the laboratory environment clean and safe.

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 17

A	B	C	D	E	FX
82.35	17.65	0.0	0.0	0.0	0.0

Provides: RNDr. Zuzana Jurašeková, PhD.

Date of last modification: 21.09.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ MFY/12	**Course name:** Mathematical Physics
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: 4.	
Course level: I.	
Prerequisities: ÚMV/FRPb/19	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 93	

A	B	C	D	E	FX
22.58	17.2	13.98	11.83	31.18	3.23

Provides: RNDr. Tomáš Lučivjanský, PhD., univerzitný docent	
Date of last modification: 16.11.2021	
Approved: prof. Mgr. Daniel Jancura, PhD.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/ MTFa/15	**Course name:** Mathematics I for physicists

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

Number of ECTS credits: 5

Recommended semester/trimester of the course: 1.

Course level: I.

Prerequisities:

Conditions for course completion:
To complete the course, it is necessary to demonstrate the acquirement of basic mathematical terms and the ability to solve problems from selected thematic units. The evaluation of the subject is according to the results from the semester and in view of the results of the written final test. During the semester, students write tests at all seminars (together 20 points) and two extensive tests (together 50 points). It is necessary to obtain at least 28 points during the semester. Then students may write the exam. To pass the exam, it is necessary to obtain at least 12 points from the maximum number of 30 points. The scale for student evaluation is as follows: 100-80-A, 79-70-B, 69-60-C, 59-50-D, 49-40-E. If a student does not achieve the required mninimal number of points from the exam test (12 points) and during the semester (together 28 points), he/she is evaluated by FX.

Learning outcomes:
After completing the course, the student can use basic mathematical terms, can solve various equations and inequations, and is acquainted with basic mathematical knowledge from the differential and integral calculus, and is able to apply the theory in concrete excercises.

Brief outline of the course:
Week 1-6: Definition of function. Domain and range of functions. Elementary functions. Inverse functions. Compositions of functions.
Week 7-14: Limit of functions. Continuity of functions. Derivation and its geometric aplications. Indefinite integrals, basic methods of integration. Definite integral and its applications.

Recommended literature:
Huťka, Benko, Ďurikovič: Matematika, Alfa, Bratislava 1991
D. Studenovská, T. Madaras, S. Mockovčiak: Zbierka úloh z matematiky pre nematematické odbory, UPJŠ 2006
D. Studenovská, T. Madaras: Matematika pre nematematické odbory, UPJŠ 2006
S. Lang: A First Course in Calculus, Springer Verlag, 1998

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 130

A	B	C	D	E	FX
20.77	13.08	18.46	16.15	19.23	12.31

Provides: RNDr. Jana Borzová, PhD., RNDr. Miriama Kmeciková

Date of last modification: 18.04.2022

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚMV/MTFb/22	**Course name:** Mathematics II for physicists

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.

Course level: I.

Prerequisities: ÚMV/MTFa/15 or ÚMV/MTCb/13

Conditions for course completion:
Mastering standard procedures for solving systems of linear equations. Understanding the concept of function of several variables, mastering the definitions of limit of function, partial derivation of a function, differential of a function, local and global extrema of a function and acquiring skills associated with their use in calculations focused mainly on functions of two variables. Mastering standard procedures for solving basic types of ordinary differential equations of the 1st order. Understanding the concept of infinite series and acquiring skills to use the basic criteria of convergence of number series for deciding on the convergence or divergence of number series.
Assessment is given on the basis of a continuous assessment and a written exam, which also includes an oral exam.
Ongoing evaluation:
Two tests during the semester - 32 p.
Small written tests during the semester - 10 p.
Solving homework - 4 p.
Active participation in exercises - 4. p.
An exam:
Final test and oral exam - 30 p.
Classification scale:
A: 91 % - 100 %, B: 81 % - 90 %, C: 71 % - 80 %, D: 61 % - 70 %, E: 51 % - 60 %, FX: 0 % - 50 %.

Learning outcomes:
The student should be able to explain the basic concepts and gain skills in using standard procedures for solving systems of linear equations using matrices and determinants. The student will expand his knowledge of the function of one variable and master the concept of a function of several variables, and will be able to explain the definitions of function limit, partial derivation of a function, differential of a function, local and global extrema of a function and acquire knowledge and skills oriented mainly on the functions of two variables. The student will learn standard procedures for solving basic types of ordinary differential equations of the 1st order. He will be able to use the acquired knowledge about solving differential equations in modeling and solving problems derived from real situations. The student will gain skills to use the basic criteria of convergence of number series when deciding on the convergence or divergence of number series.

The student will be able to use the acquired knowledge and skills in creating a mathematical model and will learn to effectively use the commands of the mathematical program Maple for routine calculations and visualization for solving created model.

Brief outline of the course:
1. - 3. Systems of linear equations, matrices, determinants.
4. - 7. Functions of several variables, continuity and limit, partial derivatives, differential, local and global extrema of a function of two variables.
8. - 11. Modeling of relations between quantities using differential equations. Methods for solving ordinary differential equations of the 1st order.
12. - 13. Sequences, infinite number series, convergence criteria of infinite number series, infinite functional series, Taylor series.

Recommended literature:
Huťka, V., Benko, E., Ďurikovič, V.: Matematika, Alfa, Bratislava 1991.
Kluvánek, I., Mišík, L., Švec, M.: Matematika II, Bratislava, 1961.
Osička, J.: Matematika pro chemiky, Brno, 2004.
Došlá, Z.: Matematika pro chemiky, Masarykova univerzita, Brno, 2011.
Hughes-Hallett, D., et al.: Applied Calculus. John Wiley & Sons, Inc., 2010.
Rogers, R., C.: The Calculus of Several Variables. 2011.

Course language:
Slovak

Notes:

Course assessment
Total number of assessed students: 33

A	B	C	D	E	FX
42.42	18.18	21.21	9.09	9.09	0.0

Provides: doc. RNDr. Stanislav Lukáč, PhD., RNDr. Miriama Kmeciková

Date of last modification: 18.04.2022

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚBEV/ MKV/15	**Course name:** Microbiology and basics of virology

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

Number of ECTS credits: 5

Recommended semester/trimester of the course: 5.

Course level: I.

Prerequisities: ÚBEV/CYT1/15

Conditions for course completion:
Attendance of practicals (at least 90%), 2 written examinations during semester, final oral examination

Learning outcomes:
Students will obtain a basic informations on viruses, prokaryotic and eukaryotic microorganisms, their cytology, physiology, genetics, ecology, classification, and importance . Information on basic methods for studying microorganisms will be provided.

Brief outline of the course:
Viruses, prokaryotic and eukaryotic microorganisms, their cytology, physiology, genetics, ecology, classification. The importance of microorganisms for humans and environment.

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 1523

A	B	C	D	E	FX
24.56	13.46	18.19	18.65	20.75	4.4

Provides: doc. RNDr. Peter Pristaš, CSc., univerzitný profesor, RNDr. Mariana Kolesárová, PhD., RNDr. Lenka Maliničová, PhD.

Date of last modification: 10.12.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ MTBF/18	**Course name:** Modern Trends in Biophysics

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: 2

Recommended semester/trimester of the course: 1.

Course level: I.

Prerequisities:

Conditions for course completion:
Elaboration of a written essay on a selected topic from the course Modern trends in Biophysics.

Learning outcomes:
This course will provide an opportunity for students to be informed about the actual trends in biophysical research in the world as well about the research performed at the Department of Biophysics, Faculty of Science of UPJS and Center for Interdisciplinary Biosciences TIP-UPJS. Completing this course, the students should be able to understand texts from popular scientific literature about biophysics or bio-sciences in general.

Brief outline of the course:
Areas of interest in biophysics and its importance and position in science.
The structure of biophysics. Characterization of molecular, cellular, medical, environmental and radiation biophysics. Scientific disciplines related to biophysics. The future of biophysics.
Lasers in life sciences.
History of laser development. Basic properties and principle of operation of lasers. Different types of lasers. Applications of lasers in biophysical experiments. Diagnostics and manipulation of samples using lasers, modern imaging methods, laser spectroscopy. Laser applications in clinical practice.
Raman spectroscopy and its application in biophysics.
Interaction of matter and light. Methods of optical spectroscopy (vibrational spectroscopy, Raman effect, mutual relation of Raman and infrared spectroscopy). Surface-enhanced Raman scattering. Raman macro- and micro-spectroscopy and imaging. Overview of the use of Raman spectroscopy with emphasis on biophysical applications (Raman spectra of proteins and other bio-macromolecules, Raman cell imaging).
PickMolTM nanotechnology based on surface-enhanced Raman spectroscopy for water and food purity screening.
This technology detects whether water or any food matrix is contaminated with persistent organic pollutants (POPs)/pesticides/drugs. The patented PickMolTM technology has recently been verified by a certified laboratory and can be adapted for any organic molecule, which means its great potential for application in other areas, e.g. pharmaceutical and chemical industry, security and sports (doping control). PickMolTM technology is: highly sensitive (ppb concentration level),

selective (detection of specific molecules), efficient (up to 90% cost savings), fast (10 minutes per analysis), portable with immediate on-site analysis.
Methods of studying ligand-macromolecule interaction.
Use of optical spectroscopy methods in the study of ligand-macromolecule interactions: UV-vis absorption spectroscopy, fluorescence spectroscopy, Raman spectroscopy techniques (classical, surface-enhanced, DCDRS). Their advantages and limits. Use of thermodynamic methods: differential scanning calorimetry (study of the stability of the ligand-macromolecule complex) and isothermal titration calorimetry (direct measurement of thermodynamic parameters associated with the formation of complexes).
Scientific superhub European XFEL and biophysics.
X-ray optics and imaging techniques in nano- and mesoscopic scale. Serial protein crystallography and imaging of biological particles (viruses, supramolecular complexes and nature-inspired nanotechnologies). Structural dynamics of biomolecules - dynamic mixing and pump-probe experiments from Terraherz to the hard X-ray region. Mapping the electronic structure of molecules and clusters and their induced dynamics. Chemical imaging. Supercomputer clusters, protein engineering and production of protein nanocrystals, digital micro- and nano-fluidics, 3D printing and additive technologies. Complementary and supporting technologies - optical superresolution techniques, cryolelectron microscopy and electron diffraction. Diffraction limited X-ray sources in the future and atomistic cell mapping. "State-of-the-art" application - demos with commentary. The ecosystem of scientific super hubs as user equipment and opportunities to use EuXFEL.
Protein evolution "in a test tube".
Principle of evolutionary methods for the development of proteins and enzymes. Examples of evolutionary methods - display technologies: ribosome display and yeast display. Application of display technology in the development of new or improved protein / enzyme properties for pharmaceutical and biotechnological applications.
Photobiostimulation
Principles of photobiostimulation, cell chromophores, application of therapeutic applications of photobiostimulation on absorption spectra of cell chromophores, perspective applications of photobiostimulation.
Metabolic flows in cells.
The importance of cell metabolism for the therapy of diseases, the principles of measuring metabolic flows, possible applications of methodology for the research in the field of cancer and neurodegenerative diseases.
Modern techniques for the study of individual molecules.
Force spectroscopy of proteins and nucleic acids (AFM, use of optical tweezers), determination of nanomechanical properties of biomolecules, overview of time trajectory analyzes of individual molecules, overview of applications of methods for studying properties of single (molecule) biomolecules: acoustic force spectroscopy, magnetic tweezers and mass photometry.
Bioenergetics.
Central concept of bioenergetics - chemiosmotic theory. The main sources of energy in living organisms. Processes in biological systems in which energy is consumed. Mitochondria - structure and basic functions. Respiratory chain in mitochondria. Respiratory chain components. Mechanism of electron transport in the respiratory chain.

Recommended literature:

1. R. Glaser. Biophysics (2nd Edition), Springer-Verlach Berlin, 2012.
2. M.B. Jackson. Molecular and cellular biophysics, Cambridge University Press, 2006.
3. D.J. Dowsett, P.A. Kenny and R.E. Johnston. The physics of diagnostic imaging, Hodder Arnold, 2006.
4. M.R. Hamblin and P. Mroz. Advances in photodynamic therapy, Artech House,

2008.
4. D. Nicholls and S. Fergusson. Bioenergetics 4, Academic Press, 2013.
5. A.D.N.J. de Grey. The mitochondrial free radical theory of aging, R.G. Landis Company, 1999.
6. N. Lane. Síla, sexualita, sebevražda. Mitochondrie a smysl života, Academia, 2012.

Course language:
English language

Notes:

Course assessment
Total number of assessed students: 22

A	B	C	D	E	FX
81.82	18.18	0.0	0.0	0.0	0.0

Provides: prof. Mgr. Daniel Jancura, PhD., doc. Mgr. Gregor Bánó, PhD., RNDr. Zuzana Jurašeková, PhD., prof. RNDr. Pavol Miškovský, DrSc., RNDr. Gabriela Fabriciová, PhD., doc. RNDr. Jozef Uličný, CSc., prof. RNDr. Erik Sedlák, DrSc., doc. RNDr. Katarína Štroffeková, PhD.

Date of last modification: 29.09.2022

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ MBF1/14 | **Course name:** Molecular Biophysics 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: 4

Recommended semester/trimester of the course: 4.

Course level: I.

Prerequisities:

Conditions for course completion:

Learning outcomes:

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 37

A	B	C	D	E	FX
56.76	27.03	10.81	2.7	2.7	0.0

Provides: prof. Mgr. Daniel Jancura, PhD., RNDr. Gabriela Fabriciová, PhD.

Date of last modification: 24.11.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ MBB1/18	**Course name:** Molecular and cell biology
Course type, scope and the method: **Course type:** Lecture / Practice **Recommended course-load (hours):** **Per week:** 2 / 2 **Per study period:** 28 / 28 **Course method:** present	
Number of ECTS credits: 5	
Recommended semester/trimester of the course: 4.	
Course level: I.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	

Course assessment
Total number of assessed students: 10

A	B	C	D	E	FX
50.0	40.0	0.0	0.0	10.0	0.0

Provides: doc. RNDr. Katarína Štroffeková, PhD., RNDr. Zuzana Naďová, PhD.

Date of last modification: 12.07.2022

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ NUM/10	**Course name:** Numerical Methods

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: 3.

Course level: I.

Prerequisities:

Conditions for course completion:
To successfully complete the course, the student must demonstrate a sufficient degree of understanding and ability to apply the basic numerical methods of mathematical analysis and algebra, which are necessary for subsequent courses in computational physics. The basis of evaluation is participation and activity in exercises and work on assignments. The condition for obtaining credits is passing 2 written tests at seminars and submitting 4 assignments (projects) electronically and with the attached computer program. The credit evaluation of the course takes into account the following student workload: direct teaching (2 credits) and individual work on projects (2 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%), F (0-49%).

Learning outcomes:
To acquaint students with the basic numerical methods of mathematical analysis and algebra needed for the next course of computational physics. The student will learn to approximate and interpolate functions, solve systems of linear and nonlinear equations, numerically derive and integrate or determine eigenvalues and eigenvectors of matrices.

Brief outline of the course:
1. Computational solution of problems and errors of numerical solution.
2. Approximation of functions.
3. Interpolation of functions.
4. Approximation by trigonometric polynomials. Fast Fourier analysis.
5. Solution of nonlinear equations, convergence conditions and error estimation of the methods.
6. Numerical methods for solving nonlinear equations.
7. Solution of systems of linear equations - direct methods.
8. Solution of systems of linear equations - iterative methods.
9. Numerical integration (quadrature) of functions.
10. Numerical differentiation of functions.
11. Eigenvalues and eigenvectors of a matrix - partial problem.
12. The complete problem of eigenvalues.

Recommended literature:

Basic literature:
POZRIKIDIS, C.: Numerical Computation in Science and Engineering, Oxford University Press, 2008.
Other literature:
HAMMING, R.W.: Numerical Methods for Scientists and Engineers, Dover, 1973.
GARCIA, A.L.: Numerical Methods for Physics, Prentice-Hall, 1994.

Course language:

Notes:

Course assessment
Total number of assessed students: 191

A	B	C	D	E	FX
13.09	16.23	23.04	23.56	20.42	3.66

Provides: prof. RNDr. Milan Žukovič, PhD.

Date of last modification: 14.09.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚCHV/ OCHB/10	**Course name:** Organic Chemistry

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

Number of ECTS credits: 5

Recommended semester/trimester of the course: 2.

Course level: I.

Prerequisities: ÚCHV/VACH/10

Conditions for course completion:
1.Participation in seminars (also applies to the online form of teaching): justified non-participation of the student in two seminars will be excused by the teacher; longer-term justified non-participation of the student in seminars must be proven by the student's mastery of the subject matter in an alternative form determined by the teacher (e.g. preparation of assignments and others...).
2. Activity at seminars (also applies to the online form of teaching) - theoretical preparation of students is required for all seminars.
3.Short written examinations at seminars (max. 50b). Credit slips in the 7th and 14th week with a total sum of 100b. To pass the E rating, it is necessary to obtain 25.5b from each test.
4. The exam is a form of test. A minimum of 51 points is required to pass the exam. The final grade is calculated as the average of the evaluation of papers in seminars, credit papers and the exam itself. Final Grade: A: 91-100b, B: 81-90b, C: 71-80b, D: 61-70b, E: 51-60b, FX: 0-50b.

Learning outcomes:
After completing the course, the student, based on the study of common and different features of compounds, should be able to assess the properties of a given type of compound from the structure and name the corresponding type of compound based on nomenclature principles. From the acquired knowledge about the structure and properties of the relevant types of hydrocarbon compounds, the student should be able to independently derive the mechanisms of individual reactions.

Brief outline of the course:

Recommended literature:
1. Online ppt presentations in the system MOODLE na moodle science.upjs.sk
2. Organic chemistry, Clayden, Greeves Warren & Wothers, Oxford university Press, 2010.
3. Organická chémia, John McMurry, Vysoké učení technické v Brne, 2007, VUTIUM, ISBN: 978-80-214-3291-8 (VUT v Brne).
4. Organická chémia, Pavol Zahradník, Mária Mečiarová, Peter Magdolen, Univerzita Komenského v Bratislave, 2019, ISBN: 978-80-223-4589-7.

Course language:
anglický

Notes:
Teaching is carried out in person or, if necessary, online, using the MS Teams tool. The form of teaching is specified by the teacher at the beginning of the semester, updated continuously.

Course assessment
Total number of assessed students: 319

A	B	C	D	E	FX
19.44	21.32	32.92	19.44	6.58	0.31

Provides: RNDr. Slávka Hamuľaková, PhD., univerzitná docentka, doc. RNDr. Miroslava Martinková, PhD., univerzitná profesorka, doc. RNDr. Mária Vilková, PhD.

Date of last modification: 15.08.2022

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ FCH1/02	**Course name:** Physical Chemistry for Biological Sciences

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.

Prerequisities:

Conditions for course completion:
Test
Exam
During an exam, a student should demonstrate his/her ability to solve theoretical exercises from the selected parts of the Physical chemistry for biological sciences. Morever, the students should be able to manifest theoretical knowledge from the chapters which are present in the brief outline of the course.

Learning outcomes:
The introduction into the fundamental knowledge of selected parts of physical chemistry with emphasis on the utilization of these knowledge for the study of physico-chemical properties of biomacromolecules and biological systems. After completing the course, the students should understand physico-chemical mechanisms of many biological processes.

Brief outline of the course:
Week 1
Physical chemistry - areas of research, importance for science, definition. Thermodynamics - definition, areas of interest. Thermodynamic system. Properties of thermodynamic system. Basic thermodynamic quantities (pressure, volume, temperature, internal energy). Zero law of thermodynamics. Ideal gas. Equation of state of an ideal gas. Gas mixtures - Dalton's law. Real gas. Van der Waals equation of state.
Week 2
1st law of thermodynamics. Internal energy, work, heat. Mathematical formulation of the 1st law of thermodynamics. Enthalpy. Heat capacity. Relationship between heat capacities at constant pressure and volume. Isothermal expansion of an ideal gas. Work in reversible and irreversible isothermal expansion. Adiabatic expansion of an ideal gas. Exothermic and endothermic reactions and processes. Standard state of substances. Hess's law.
Week 3
Examples of spontaneous processes in nature. Definitions of the 2nd law of thermodynamics (Kelvin, Celsius). Entropy - introduction of the term. Thermodynamic definition of entropy. Entropy as a state function. Carnot cycle. Efficiency of a heat engine. Claussius inequality. Entropy

of isothermal expansion, gas mixing, melting and evaporation processes. Dependence of entropy on temperature. Nernst's heat theorem. 3rd law of thermodynamics.

Week 4

Entropy as a property determining the spontaneity of processes. Criteria of process spontaneity at constant volume and constant pressure. Helmoltz and Gibbs free energy. Properties of Helmoltz energy. Properties of Gibbs energy. Standard Gibbs energy of a chemical reaction. Dependence of Gibbs energy on temperature - Gibbs-Helmoltz equation. Dependence of Gibbs energy on pressure for solids, liquids and gases. Simple mixtures. Partial molar volume. Partial molar Gibbs energy, chemical potential.

Week 5

Chemical potential in a liquid. Raoult's law, the ideal solution. Henry's law, ideally diluted solution. Mixing solutions, ideal solutions. Residual functions and regular solutions. Colligative properties. Increasing the boiling point and decreasing the melting point of the liquid in which the soluble chemical compound is located. Osmosis. Solvent activity, soluble substance activity.

Week 6

Chemical equilibrium. Gibbs energy of a chemical reaction. Chemical equilibrium in an ideal gas. Equilibrium constant of chemical reaction. Temperature dependence of the equilibrium constant - van‘t Hoff's equation. Stability of protein structure. Thermal denaturation of proteins. Van’t Hoff enthalpy of protein denaturation. Chemical denaturation of proteins. Physiological consequences of incorrectly folded proteins.

Week 7

Examples of molecular associations and their significance for biological systems. Dissociation and association binding constants. Determination of dissociation binding constant - Langmuir isotherm. Cooperativity in ligand-macromolecule interactions. Cooperativity - simultaneous ligand binding, Hill's equation. Cooperativity - gradual binding of ligands. Allosteric interactions. Qualitative description of the Monod - Wyman - Changeaux model for cooperative binding of ligands to macromolecules. Experimental methods used to study the ligand - macromolecule interactions.

Week 8 Chemical and biochemical kinetics - basic definitions. Rates of chemical reactions. Rate constant. Order of chemical reaction. First order reactions. Second order reactions. Consecutive reactions. Determination of the rate law. Reverse chemical reactions. Relaxation processes. Temperature dependence of rate constants - Arrhenius equation. Experimental techniques used to determine the rates of chemical reactions. Transition state theory - Eyring's theory.

Week 9

Enzymes - characterization and classification. Equilibrium model of enzyme kinetics. Steady state model of enzyme kinetics. Experimental determination of maximum rate and Michaelis-Menten constant in enzymatic reactions. Deviations from Michaelis-Menten kinetics. Enzyme inhibition. Reversible inhibition. Competitive, non-competitive and uncompetitive inhibition.

Week 10

Kinetics of photophysical and photochemical processes. Jablonski diagram. Fluorescence, phosphorescence. Quantum yields of photophysical processes. Quenching of the excited states of molecules by external factors. Fluorescence quenching. Stern-Volmer equation. Förster resonance energy transfer (FRET). Biological application of FRET.

Week 11

Electrochemical reactions. Electrochemical cell. Standard redox potentials. Relationship between Gibbs energy change and electrochemical potential. Temperature dependence of electrochemical potential. Use of electrochemical cells. Determination of redox potential. Ionic electrochemical gradient. Proton motive force. Nernst potential. Introduction to the respiratory chain in mitochondria.

Week 12

Acids and bases. Acid-base properties of water. pH - measurement of environmental acidity. Dissociation of acids and bases - acid-base equilibrium. Henderson - Hasselbalch equation. Buffers.

Recommended literature:

1. P. Atkins and J. de Paula. Atkins's Physical Chemistry (9th Edition), Oxford University Press, 2010.
2. P. Atkins. Fyzikálna chémia (slovenský preklad 6. vydania), STU Bratislava, 1999.
3. P. Atkins, J. De Paula. Fyzikální chemie (český preklad 9. vydania), VŠCHT Praha, 2013
4. R.Chang. Physical Chemistry for the Biosciences, University Science Book, 2006.
5. D. Eisenberg and D. Crothers. Physical Chemistry with Applications to the Life Sciences, Benjamin/Cummings, 1979.
6. K. van Holde, W. Johnson and P. Ho. Principles of Physical Biochemistry, Prentice Hall, 1988.
7. D.T. Haynie. Biological Thermodynamics (2nd Edition), Cambridge University Press, 2008.
8. A.P.H. Peters. Concise Chemical Thermodynamics (3rd Edition), CRC Press, Taylor & Francis Group, 2010.
9. I. Tinoco, jr., K. Sauer, J.C. Wang, J.C. Puglisi, G. Harbison and D.Rovnyak. Physical Chemistry – Principles and Applications in Biological Sciences (5th Edition), Pearson, 2014.
10. A. Cooksy. Physical Chemistry- Thermodynamics, Statistical Mechanics, and Kinetics, Pearson, 2014.

Course language:
English language

Notes:

Course assessment
Total number of assessed students: 123

A	B	C	D	E	FX
17.89	27.64	34.15	11.38	8.94	0.0

Provides: prof. Mgr. Daniel Jancura, PhD., RNDr. Veronika Huntošová, PhD.

Date of last modification: 17.09.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ ZFP1a/03	**Course name:** Physics Practical I

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

Number of ECTS credits: 3

Recommended semester/trimester of the course: 2.

Course level: I.

Prerequisities:

Conditions for course completion:
The active work during semester and hand in all reports.
Vindication of reports.

Learning outcomes:
Developing proper laboratory habits, skills and verify their theoretical knowledge.

Brief outline of the course:
The goal of this laboratory exercises is to familiarize the students with measurement methods, with kinds and calculus of mistakes, with measured results processing, and with presentation of results. The students gain practical skills, and verify their theoretical knowledge of first semester introductory physics course. They develop proper laboratory habits.
Laboratory assignment:
1. Density measurements of liquids and solids.
2. Radius measurements of spherical cap. Measurements of surface using planimeter.
3. Gravitational acceleration measurements using mathematical and physical pendulum.
4. Moment of inertia measurement using physical and torsion pendulum.
5. Measurements of Young's modulus.
6. Measurement of coefficient of viscosity.
7. Measurement of the speed of sound.
8. Measurements of general gas constant and Boltzmann constant.
9. Measurements of thermal expansivity of air.
10. Measurements of thermal capacity of matter.
11. Measurement of the surface tension.

Recommended literature:
Degro, J., Ješková, Z., Onderová, Ľ., Kireš, M.: Základné fyzikálne praktikum I. (Basic physical measurements I), Ed. PF UPJŠ Košice 2007.
Standards STN ISO 31. Slovenský inštitút normalizácie v Bratislave (Slovak institute of technical standards in Bratislava),1997.

Ješková, Z.: Computer based experiments in thermodynamics using IP COACH,ed. PF UPJŠ in Košice, 2004.

Course language:
english

Notes:

Course assessment
Total number of assessed students: 278

A	B	C	D	E	FX
56.83	25.54	12.95	3.96	0.72	0.0

Provides: doc. RNDr. Marián Kireš, PhD., doc. RNDr. Jozef Hanč, PhD.

Date of last modification: 29.03.2020

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ ZFP1b/24	**Course name:** Physics Practical II
Course type, scope and the method: **Course type:** Practice **Recommended course-load (hours):** **Per week:** 3 **Per study period:** 42 **Course method:** present	
Number of ECTS credits: 3	
Recommended semester/trimester of the course: 4.	
Course level: I.	
Prerequisities: ÚFV/VF1b/24	
Conditions for course completion: To successfully complete the course, the student must measure at least 11 experimental tasks, process and analyze the measured results and evaluate the experimental results in the form of a protocol. The condition for the implementation of another experimental task is the submission of a protocol from the previous exercise. The condition for the implementation of the practical task is sufficient theoretical training at home. If the student is not ready for the task in advance, the teacher can send him home and the student must replace the exercise at another time. The credit evaluation of the course takes into account the following student workload: 1 credit: self-study of recommended literature and subsequent direct teaching 1 credits: realization of experimental exercise and subsequent defense of measuring procedure - it is obligatory to complete all practical tasks in the semester, 1 credit: elaboration and submission of protocols from measurements, which are evaluated.	
Learning outcomes: By completing the course, the student will get acquainted with selected physical experiments in the field of electricity and magnetism and supplement the theoretical knowledge acquired in the course General Physics in a practical way. The result of education is: a) Complementing and summarizing knowledge and experimental skills in the field of electricity and magnetism. b) Gaining practical experience with recording, analysis and interpretation of experimental data from practical measurements. c) Gaining experience with the presentation of experimental results in the form of a measurement protocol.	
Brief outline of the course: Students on practical exercises are working in pairs experimental tasks in the field of electrical, electromagnetic and magnetic properties of matters. 1. Electrical Resistivity 2. Self - and Mutual Inductance and Capacity	

3. Serial and Parallel Resonance
4. Thermal Dependence of Selected Electrical Phenomena in Solids
5. The Characteristics of Semiconductor Diod
6. The Characteristics of Semiconductor Bipolar Transistor
7. Magnetic Hysteresis
8. Hall Constant Measurements
9. Measurements of Horizontal Component of Earth Magnetic Field
10. Measuring characteristics of switching components
11. Measuring the properties of optoelectronic components
12. Electric current in liquids and electrolysis

Recommended literature:

1. Tumanski S, Handbook of magnetic measurements, CRC press, 2011.
2. Fiorillo F, Characterization and Measurement of Magnetic Materials, Elsevier, 2004.

Course language:

english

Notes:

Teaching is carried out in person. If necessary, part of the teaching can be realized remotely using the MS Teams or BBB tool. At the beginning of the semester, the teacher sets the conditions for completing and mastering the course.

Course assessment

Total number of assessed students: 1

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

Provides: doc. RNDr. Adriana Zeleňáková, DrSc., doc. RNDr. Ján Füzer, PhD.

Date of last modification: 21.02.2024

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ ZFP1c/24 | **Course name:** Physics Practical III

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

Number of ECTS credits: 3

Recommended semester/trimester of the course: 3.

Course level: I.

Prerequisities: ÚFV/VF1c/24

Conditions for course completion:
Measurements of experimental tasks, their evaluation in the form of a written report, which must be defended. As a part of evaluation there is is also a good theoretical preparation for the measurement of the task.

Learning outcomes:
To gain some physical inside into some of the concepts presented in the lectures. b. To gain some practice in data collection, analysis and interpretation of resumance. c. To gain experience and report writing presentation and results.

Brief outline of the course:
Oscilations. Pendulum. Composition and decomposition of oscillations. Resonance. The speed of sound. Refractive index. Lense's focal length. Interference. Diffraction. Diffraction and reflection of waves. Polarization. The speed of light. Quantum optics.

Recommended literature:
Degro,J., Ješková, Z., Onderová,Ľ., Kireš,M.: Základné fyzikálne praktikum I, PF UPJŠ Košice, 2006
P. Kollár a kol. Základné fyzikálne praktikum II, PF UPJŠ Košice, 2006
J. Brož Základy fysikálních měření, SPN Praha, 1981.

Course language:
slovak, english

Notes:

Course assessment
Total number of assessed students: 1

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

Provides: doc. RNDr. Marián Kireš, PhD., doc. RNDr. Ján Füzer, PhD.

Date of last modification: 21.02.2024

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice
Faculty: Faculty of Science
Course ID: ÚFV/ PEMBF1/18 — **Course name:** Practical exercises in experimental methods of biophysics 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: 5.
Course level: I.
Prerequisities: ÚFV/EMBF1/18
Conditions for course completion:
Learning outcomes:
Brief outline of the course:
Recommended literature:
Course language:
Notes:
Course assessment Total number of assessed students: 10

A	B	C	D	E	FX
80.0	20.0	0.0	0.0	0.0	0.0

Provides: RNDr. Gabriela Fabriciová, PhD.
Date of last modification: 25.11.2021
Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ PEMBF2/18	**Course name:** Practical exercises in experimental methods of biophysics 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: 5.

Course level: I.

Prerequisities: ÚFV/EMBF2/18

Conditions for course completion:

Learning outcomes:

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 9

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

Provides: prof. RNDr. Erik Sedlák, DrSc., RNDr. Gabriela Fabriciová, PhD.

Date of last modification: 30.11.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ PEMBF3/18	**Course name:** Practical exercises in experimental methods of biophysics 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: 6.

Course level: I.

Prerequisities: ÚFV/EMBF3/18

Conditions for course completion:
Elaboration of protocols.

Learning outcomes:
The students gain experimental skills in the methods of confocal fluorescence microscopy, time-resolved fluorescence microscopy (FLIM / PLIM), flow cytometry, microfluidics and the development of experimental apparatuses in the field of biophotonics.

Brief outline of the course:
1-2. Sample preparation for confocal fluorescence microscopy and vital fluorescence imaging in cells.
3-4. Time-resolved fluorescence microscopy (FLIM) - sample preparation and fluorescence lifetime imaging in cells.
5. Immuno-fluorescence imaging - sample preparation for confocal fluorescence microscopy and imaging of selected proteins in cells.
6. Flow cytometry - detection of fluorescent labels in living cells.
7. Setting up the function generator and the digital oscilloscope (the influence of input resistance, triggering and averaging of time courses). Noise monitoring, optimization of shielding and grounding of devices. Measurement using a laboratory card, evaluation of spectral noise density.
8. Safety training for working with optical radiation in practice. Safe work with lasers, setting the beam path through a cuvette. Measuring fluorescence spectra using a spectrograph.
9. Measurement of weak optical signals. Comparison of different types of photodiodes. Connection and setting of the lock-in amplifier when measuring with a chopped laser beam.
10. Temperature regulation and measurement. Connection and adjustment of a PID temperature regulator using a Peltier cell in combination with a thermocouple.
11. Preparation of a simple microfluidic system. Channel design. Mold preparation. Fabrication of a microfluidic system using PDMS.
12. Setting up the imaging system using a CMOS camera. Measurement of fluid flow rate in a microfluidic system based on video recording.

Recommended literature:
1. Wolfgang Becker: The bh TCSPC Handbook Seventh Edition, Becker & Hickl GmbH 2017;
2. Guy Cox: Optical Imaging Techniques in Cell Biology, Taylor & Frances;

3. Howard M. Shapiro: Practical Flow Cytometry Fourth edition, 2003;
4. Nikolas Long and Wing-Tak Wong: The chemistry of molecular imaging, Wiley 2014

Course language:
Slovac language, English.

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: doc. Mgr. Gregor Bánó, PhD., RNDr. Veronika Huntošová, PhD.

Date of last modification: 22.09.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ KVM I/11	**Course name:** Quantum Mechanics

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

Number of ECTS credits: 8

Recommended semester/trimester of the course: 3.

Course level: I.

Prerequisities:

Conditions for course completion:
To successfully complete the course, the student must demonstrate sufficient understanding of the basic terms, concepts and applications of quantum physics. Knowledge of basic concepts of quantum physics is required at the level of their mathematical definition, as well as their physical content and specific applications. During the semester, the student must continuously master the content of the curriculum so that he can actively and creatively use the acquired knowledge in solving specific computational tasks during the exercises and pass continuous written tests taken into account in the overall evaluation of the subject. The condition for obtaining credits is passing 2 continuous written tests in exercises and an oral exam, which consists of one more demanding calculation task and theoretical questions. The credit evaluation of the course takes into account the following student workload: direct teaching (3 credits), self-study (2 credits), individual consultations (1 credit) and assessment (2 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%), F (0-49%).

Learning outcomes:
After completing lectures and exercises, the student will have sufficient physical skills, knowledge and mathematical apparatus enabling independent solution of a wide range traditional and current scientific problems in quantum physics. At the same time, he will gain an overview of the applications of quantum physics in various areas of physics - nuclear physics, condensed matter physics, statistical physics, quantum information theory, etc.

Brief outline of the course:
1. Subject matter, experimental and theoretical foundations of quantum mechanics (QM).
2. Wave formulation of QM. Postulate about wave function, superposition principle and postulate about operators.
3. Eigenvalues and eigenfunctions of operators. Measurement of quantities and reduction of wave function.
4. Time-independent and time-dependent Schrödinger equation. Ehrenfest equations and integrals of motion. Continuity equation.
5. Matrix formulation of QM, Dirac symbolics, calculation of mean values and density matrix.
6. Current immeasurability of physical quantities, Heisenberg uncertainty relations.

7. Solution of the Schrödinger equation for a particle in an infinitely deep potential well and a particle in a finite potential well. Bound and scattering states.
8. Passage of a particle through a potential barrier: tunneling and barrier reflection.
9. Solution of Schrödinger equation for linear harmonic oscillator.
10. Particle motion in the central potential field, angular part of the Schrödinger equation.
11. Particle motion in the central potential field, radial part of the Schrödinger equation. Hydrogen atom.
12. Electron spin, Pauli matrix. Principle of indistinguishability of identical particles, fermions and bosons. Pauli's exclusion principle.
13. Paradoxes and modern problems of QM. Quantum entanglement, nonlocality, computing, cryptography and teleportation.

Recommended literature:

1. Ľ. Tóth, M. Tóthová, Kvantová a štatistická fyzika I, Rektorát Univerzity P. J. Šafárika, 1982. (in Slovak language)
2. Ľ. Skála, Úvod do kvantovej mechaniky, Academia, Praha, 2005. (in Czech language)
3. J. Pišút, L. Gomolčák, Úvod do kvantovej mechaniky, Bratislava 1983. (in Slovak language)
4. W. Greiner, Quantum Mechanics, 4th edition, Springer, Berlin, 2000.
5. A. C. Philips, Introduction to Quantum Mechanics, Wiley, Weinheim, 2003.
6. D. J. Griffiths, Introduction to Quantum Mechanics, Prentice Hall, New Jersey, 1995.
7. G. Auletta, M. Fortunato, G. Parisi, Quantum Mechanics, Cambridge University Press, Cambridge, 2009.

Course language:

Notes:

Course assessment

Total number of assessed students: 119

A	B	C	D	E	FX
22.69	21.01	17.65	11.76	21.01	5.88

Provides: doc. RNDr. Jozef Strečka, PhD.

Date of last modification: 19.09.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ KVM II/08	**Course name:** Quantum Mechanics II.

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: 4.

Course level: I.

Prerequisities: ÚFV/KVM/08 or ÚFV/KVM I/11

Conditions for course completion:
To successfully complete the course, the student must demonstrate sufficient understanding of the basics terms, concepts and applications of quantum physics. Knowledge of basic concepts is required from quantum physics at the level of their mathematical definition as well as their physical content and concrete applications. During the semester, the student must continuously master the content of the curriculum in order to gain the acquired knowledge in order to actively and creatively use them in solving specific tasks during the exercises and complete the continuous written test taken into account in the overall evaluation of the subject. The condition for obtaining credits is passing 1 continuous written test in exercises and an oral exam, which consists of one more complex computational task and theoretical questions. The credit evaluation of the course takes into account the following student workload: direct teaching (2 credits), self-study (2 credits), individual consultations (1 credit) and assessment (1 credit). Minimum threshold for passing
the subject is to obtain at least 50% of the total score, while it is used the following rating scale: A (90-100%), B (80-89%), C (70-79%), D (60-69%), E (50-59%), F (0-49%).

Learning outcomes:
After completing lectures and exercises, the student will have sufficient physical skills, knowledge and mathematical apparatus enabling independent solution of a wide range traditional and current scientific problems in quantum physics using approximate methods. At the same time, he will gain an overview of the applications of quantum physics in various fields of physics such as atomic and nuclear physics, condensed matter physics, statistical physics, quantum theory of magnetism, etc.

Brief outline of the course:
1. Stationary perturbation theory for non-degenerate quantum-mechanical systems with discrete energy spectrum.
2. Stationary perturbation theory for degenerate quantum-mechanical systems with discrete energy spectrum. Zeeman and Stark effects.
3. Stationary perturbation theory for two-level quantum-mechanical systems with two closely-spaced energy levels: crossing and selfavoided crossing of energy levels.
4. Ritz's variational method. Bound state of a quantum-mechanical system with attractive potential.
5. Applications of Ritz's variation method in finding the ground state of quantum spin models.

6. Nonstationary perturbation theory for non-degenerate quantum-mechanical systems with discrete energy spectrum. A special case of constant, adiabatic and short-rapid perturbation.
7. Nonstationary perturbation theory for quantum-mechanical systems with discrete-continuous energy spectrum. Harmonic perturbation and Fermi's golden rule.
8. Quantum-mechanical solution of the time-indepedent Schrődinger equation for the helium atom using stationary perturbation theory. Orthohelium and parahelium.
9. Quantum-mechanical solution of the time-indepedent Schrődinger equation for a hydrogen molecule using stationary perturbation theory. Heitler-London theory of valence bonds.
10. Quantum-mechanical solution of the time-indepedent Schrődinger equation for a hydrogen molecule using the Ritz variational method. LCAO method.
11. Hartree and Hartree-Fock method for multielectron atoms.

Recommended literature:

1. V. Ilkovič, Kvantová teória II, Scriptum UPJŠ, Košice, 1989. (in Slovak)
2. J. Pišút, L. Gomolčák, Úvod do kvantovej mechaniky, Bratislava 1983. (in Slovak)
3. W. Greiner, Quantum Mechanics, 4th edition, Springer, Berlin, 2000.
4. D. J. Griffiths, Introduction to Quantum Mechanics, Prentice Hall, New Jersey, 1995.
5. G. Auletta, M. Fortunato, G. Parisi, Quantum Mechanics, Cambridge University Press, Cambridge, 2009.

Course language:
EN - english

Notes:

Course assessment
Total number of assessed students: 132

A	B	C	D	E	FX
28.79	15.15	17.42	15.15	18.94	4.55

Provides: doc. RNDr. Jozef Strečka, PhD.

Date of last modification: 19.09.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SPBFb1/18	**Course name:** Semestral thesis 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: 4	
Recommended semester/trimester of the course: 5.	
Course level: I.	
Prerequisities:	
Conditions for course completion: Successful completing the course, requires the student to demonstrate adequate level of the assigned tasks set by the project leader at the beginning of the semester to the required extent and at the required level. The assignments are formulated by the teacher at the beginning of the semester, the project leader is usually the supervisor of the final thesis. Tasks include e.g. study of literature in the field, mastering the operation of experimental equipment, sample preparation technology, preparation and implementation of the experiment, processing of the obtained data, or collaborating during the preparation of a scientific publication. Credit evaluation takes into account the time requirements of the student when working on a semester project in the range of 50 hours per semester. Individual activities of the student are evaluated by the project leader, the overall work of the student is evaluated by points on a point scale of 0 - 100 points. The minimum threshold for obtaining a rating is 50% of the rating scale, which is determined as follows: A 100-91% B 90-81% C 80-71% D 70-61% E 60-50% Fx 49-0%.	
Learning outcomes: After completing the course, the student will acquire knowledge and skills associated with scientific work in the field of biophysics. By actively participating in individual research teams, students will extend their knowledge in the relevant part of biophysics, acquire experimental skills in operating contemporary scientific equipment, study of the literature will improve their language skills. Data processing resp. the creation of original software will improve their computer skills.	
Brief outline of the course: Program for semestral project is prepared individually for each student by supervisor of the project at the beginning of each semester and can be focused on search in literature for a selected area of research, preparation of experiment and its performing, creation of software for data acquisition and analysis, collaboration during preparation of manuscript, presentation of the obtained results for department audience. Supervisor of the project will specify the topic of the project.	
Recommended literature: Selected scientific journals and books.	
Course language:	
Notes:	

Subject Semester work I is realized in attendance form. If necessary (e.g. Covid pandemic) it is taught online using software MS Teams, which allows to maintain contact with students even in adverse conditions and also allows to meet the requirements of the subject.

Course assessment
Total number of assessed students: 8

abs	n
100.0	0.0

Provides:

Date of last modification: 25.02.2022

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ SPBFb2/18	Course name: Semestral thesis 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: 6

Recommended semester/trimester of the course: 6.

Course level: I.

Prerequisities:

Conditions for course completion:
Successful completing the course, requires the student to demonstrate adequate level of the assigned tasks set by the project leader at the beginning of the semester to the required extent and at the required level. The assignments are formulated by the teacher at the beginning of the semester, the project leader is usually the supervisor of the final thesis. Tasks include e.g. study of literature in the field, mastering the operation of experimental equipment, sample preparation technology, preparation and implementation of the experiment, processing of the obtained data, or collaborating during the preparation of a scientific publication. Credit evaluation takes into account the time requirements of the student when working on a semester project in the range of 50 hours per semester. Individual activities of the student are evaluated by the project leader, the overall work of the student is evaluated by points on a point scale of 0 - 100 points. The minimum threshold for obtaining a rating is 50% of the rating scale, which is determined as follows: A 100-91% B 90-81% C 80-71% D 70-61% E 60-50% Fx 49-0%.

Learning outcomes:
After completing the course, the student will acquire knowledge and skills associated with scientific work in the field of biophysics. By actively participating in individual research teams, students will extend their knowledge in the relevant part of biophysics, acquire experimental skills in operating contemporary scientific equipment, study of the literature will improve their language skills. Data processing resp. the creation of original software will improve their computer skills.

Brief outline of the course:
Program for semestral project is prepared individually for each student by supervisor of the project at the beginning of each semester and can be focused on search in literature for a selected area of research, preparation of experiment and its performing, creation of software for data acquisition and analysis, collaboration during preparation of manuscript, presentation of the obtained results for department audience. Supervisor of the project will specify the topic of the project.

Recommended literature:
Selected scientific journals and books.

Course language:

Notes:

Subject Semester work I is realized in attendance form. If necessary (e.g. Covid pandemic) it is taught online using software MS Teams, which allows to maintain contact with students even in adverse conditions and also allows to meet the requirements of the subject.

Course assessment
Total number of assessed students: 6

abs	n
100.0	0.0

Provides:

Date of last modification: 30.03.2022

Approved: prof. Mgr. Daniel Jancura, PhD.

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. Mgr. Daniel Jancura, PhD.

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. Mgr. Daniel Jancura, PhD.

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. Mgr. Daniel Jancura, PhD.

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. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SVK/13	**Course name:** Student Scientific Conference
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week:** **Per study period:** **Course method:** present	
Number of ECTS credits: 4	
Recommended semester/trimester of the course:	
Course level: I., 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: 26	
abs	n
100.0	0.0
Provides:	
Date of last modification: 30.11.2021	
Approved: prof. Mgr. Daniel Jancura, PhD.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ DGS/21	**Course name:** Students` Digital Literacy

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.

Prerequisities:

Conditions for course completion:
Summary evaluation based on ongoing assessment:
1. Practical ongoing assignments and their defense (at least 50% needed)
3. Active participation during face-to-face contact learning in classical or virtual classroom (3 absences allowed) and during online learning (no absence, uploading all individual ongoing assignments)

Learning outcomes:
The student should obtain and know to apply basic knowledge and skills in working with current digital technologies (mobile phone, tablet, laptop, web technologies):
1. according to the current European framework for the Digital competence DigComp and ECDL
2. for better and more effective learning, work and active life in higher education, later lifelong learning and further career prospects.

Brief outline of the course:
01.-02. Basic digital skills, DigComp framework, ECDL
- modern web browser and its personalization
- security, privacy, responsible use of DT
03.-05. Search, collection and evaluation of digital content
- scanning, audio recording and speech resolution, optical resolution (OCR)
- digital notebooks (Google keep, Evernote, Onenote)
- evaluation of digital resources (Google forms and sections)
06.-08. Editing and creating digital content
- cloud and interactive documents
(text and spreadsheet editors - Google, Microsoft, Jupyter)
- work with pdf documents, e-books and videos
(Kami, Google books, Screencasting)
09. - 10. Organization, protection and sharing of digital content
- modern LMS and cloud storage
(Google Classroom, Microsoft team, Google Drive, Dropbox)
- time management (Google Calendar)
11.-13. Digital communication and cooperation

- collaborative interactive whiteboards (Jamboard, Whiteboard)
- online presentations and online meetings
(Google presentations, Powerpoint, Google meet, Microsoft teams)

Recommended literature:

1. Carretero Gomez, S., Vuorikari, R. and Punie, Y., DigComp 2.1: The Digital Competence Framework for Citizens with eight proficiency levels and examples of use, Luxembourg, 2017, ISBN 978-92-79-68006-9, https://www.ecdl.sk/
2. Bruff, D. (2019). Intentional Tech: Principles to Guide the Use of Educational Technology in College Teaching (1st edition). Morgantown: West Virginia University Press.
3. Baker, Y. (2020). Microsoft Teams for Education. Amazon Digital Services.
4. Miller, H. (2021). Google Classroom + Google Apps: 2021 Edition. Brentford: Orion Edition Limited.

Course language:
slovak

Notes:

Course assessment
Total number of assessed students: 245

A	B	C	D	E	FX
76.33	5.31	2.86	0.0	14.69	0.82

Provides: doc. RNDr. Jozef Hanč, PhD.

Date of last modification: 26.01.2022

Approved: prof. Mgr. Daniel Jancura, PhD.

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. Mgr. Daniel Jancura, PhD.

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. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ MSB/10	**Course name:** System Biology Modeling

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: 5.

Course level: I.

Prerequisities:

Conditions for course completion:
Solving intermediate motivating challenges given at the lectures.
Exam.

Learning outcomes:
To provide an overview of the computational techniques and achievable results in the emerging field of systems biology.

Brief outline of the course:
Basics of molecular modeling. Physical structure of biopolymers. Foldamers, Levinthal paradox and Anfinsen principle. Essentials of molecular modeling and molecular simulations. Examples of procedures and their results.
Biological polymers as sequences. Sequence comparision.
Biological databases of sequences, acces and work. BLAS, FASTA, scoring matrices. Sugar code as an example of non-linear code. Examples of use and results.
Molecular interaction networks, modeling of reaction kinetics. Application of graph-based approaches. Stochastic and deterministic modeling. Typical examples of use. Outlines and perspectives of systems biology and systems medicine. Chalenges of synthetic biology.

Recommended literature:
Alon, Uri. *An Introduction to Systems Biology: Design Principles of Biological Circuits*. 1st ed. Chapman and Hall/CRC, 2006.
Campbell, A. Malcolm, and Laurie J. Heyer. *Discovering Genomics, Proteomics and Bioinformatics*. 2nd ed. Benjamin Cummings, 2006.
Gabius, Hans-Joachim. *The Sugar Code: Fundamentals of Glycosciences*. Wiley-VCH, 2009.

Course language:

Notes:

Course assessment
Total number of assessed students: 224

A	B	C	D	E	FX
91.52	6.25	1.79	0.45	0.0	0.0

Provides: doc. RNDr. Jozef Uličný, CSc.

Date of last modification: 08.09.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ TME1/03	**Course name:** Theoretical Mechanics

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., 3.

Course level: I.

Prerequisities: ÚFV/VF1a/12

Conditions for course completion:
To successfully complete the course, the student must demonstrate sufficient understanding of all basic concepts and applications of theoretical mechanics. Knowledge of basic concepts at the level of their mathematical definition is required, as well as their physical content and principled applications. The student must be able to actively master the content of the curriculum continuously during the semester, so that he can actively and creatively use the acquired knowledge in solving specific problems in exercises and independent homework. In addition to direct participation in teaching, the student is obliged to independently study professional topics assigned by the teacher and also to develop and present two home assignments. The condition for obtaining credits is, in addition to participation in teaching, also the successful completion of the 3rd written tests from exercises and lectures and the elaboration of home assignments. The minimum limit for passing the exam is to obtain 51% of the total score, which takes into account all required activities with relevant weight.
Rating scale: A - 91% -100% points, B - 81% -90% points, C - 71% -80% points, D - 61% -70% points, E - 51% -60% points.

Learning outcomes:
The lecture on Theoretical Mechanics is the first lecture of an extensive university course in theoretical physics, where the student gets acquainted with fundamental theoretical concepts (e.g., generalized coordinates, velocities and momentum, phase space, Hamiltonian Lagrangian ...), which constitute the basis for understanding advanced theoretical methods of advanced courses such as quantum mechanics, statistical physics and quantum field theory. For this reason, attending this lecture is essential for all physics students. In addition to deep physical knowledge, students will also gain a practical experience in solving complex problems of mechanics of systems of mass points, continuum mechanics, hydrostatics and hydrodynamics.

Brief outline of the course:
1. Dynamics of a free system of mass points.
2. Motion of a constrained system of mass points. Constrains and their classification. The principle of virtual work and search for equilibrium positions.
3. D'Alembert's principle. Lagrange equations of the first kind. Generalized coordinates and generalized forces.

4. Lagrange equations of the second kind and generalized potential.
5. Basic properties of Lagrange equations. First integrals of equations of motion: Integral of energy and generalized momentum.
6. Integral principles. Variation of functions and integrals. Hamilton's principle.
7. Hamilton's function. Hamilton's canonical equations.
8. Mechanics of a perfectly rigid body. Position of a rigid body in space, independent coordinates. The speed of the points of a rigid body.
9. Center of gravity, linear and angular momentums of a rigid body. Tensor of inertia.
10. Kinetic energy of a rigid body. Euler angles and Euler kinematic equations. Euler's equations of motion of a perfectly rigid body.
11. Basic concepts of continuum mechanics. Vector and tensor of deformation. Stress vector and stress tensor. Equilibrium conditions and equations of motion of a continuum. Generalized Hooke's law. Waves in an elastic environment.
12. Mechanics of fluids. Conditions of a hydrostatic equilibrium. Continuity equation. Euler's equations of motion of an ideal fluid.

Recommended literature:

1. Meirovitch L.: Methods of Analytical dynamics, McGraw-Hill, New York, 1970.
2. Taylor T.T.: Mechanics: Classical and Quantum, Pergamon Press, Oxford, 1976.
3. Strelkov S.P.: Mechanics, Mir Publishers, Moscow, 1985.
4. Greiner W.: Classical Mechanics, Springer-Verlag, Berlin, 2010.
5. Goldstein H.: Classical Mechanics, Addison-Wesley, London, 1970.
6. Barger V., Olsson M.: Classical Mechanics: A Modern Perspective, McGraw-Hill, London, 1973.

Course language:
1. Slovak,
2. English

Notes:

Course assessment
Total number of assessed students: 205

A	B	C	D	E	FX
33.17	13.66	17.56	15.12	9.27	11.22

Provides: prof. RNDr. Michal Jaščur, CSc.

Date of last modification: 01.10.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ TEP1/03	**Course name:** Theory of the Electromagnetic Field
Course type, scope and the method: **Course type:** Lecture / Practice **Recommended course-load (hours):** **Per week:** 3 / 1 **Per study period:** 42 / 14 **Course method:** present	
Number of ECTS credits: 5	
Recommended semester/trimester of the course: 4., 6.	
Course level: I.	
Prerequisities: ÚFV/VFM1b/15 or ÚFV/VF1b/03	
Conditions for course completion: To successfully complete the course, the student must demonstrate sufficient understanding of the basics terms, concepts and applications of electromagnetic field theory. Knowledge of basic concepts is required at the level of their mathematical definition, as well as their physical content and specific applications. During the semester, the student must continuously master the content of the curriculum so that he can actively and creatively use the acquired knowledge in solving specific tasks during the exercises and pass continuous written tests taken into account in the overall evaluation of the subject. The condition for obtaining credits is passing 2 continuous written tests in exercises and an oral exam, which consists of theoretical questions covering the entire scope of the course. The credit evaluation of the course takes into account the following student workload: direct teaching (2 credits), self-study (1 credit), individual consultations (1 credit) and assessment (1 credit). 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%), F (0-49%).	
Learning outcomes: After completing lectures and exercises, the student will have sufficient physical skills, knowledge and mathematical apparatus enabling independent solution of a wide range scientific problems in electromagnetic field theory. The student also gets an overview of applications of electromagnetic field theory in various fields of physics such as electricity, magnetism, optics, etc.	
Brief outline of the course: 1. Charge density and current density. Continuity equation. Definition of electromagnetic field. 2. System of Maxwell's equations in vacuum: differential formulation of Gauss' law of electrostatics, law of total current. The absence of magnetic monopoles and the law of electromagnetic induction. 3. Scalar and vector potential, gauge transformation. Wave equations for potentials. Energy conservation law in electromagnetic field theory: Poynting vector. 4. Conservation law of momentum of electromagnetic field: Maxwell's stress tensor. 5. Electrostatic field in vacuum and its potential. Potential of charges distributed in space and on surfaces. Boundary conditions on a charged area.	

6. Multipole development of charge system potential. Electrostatic field energy. Electrostatic potential energy of a charge system and its multipole development in an external electric field.
7. Dielectric polarization. Vector of electrical induction, dielectric susceptibility and permittivity. Electrostatic field induced by a system of free charges in a dielectric, boundary conditions at the interface of two dielectrics.
8. Magnetic fields of stationary currents in vacuum; Biot-Savart law.
9. Stationary magnetic field of closed elementary current system, magnetic moment. Magnetization of magnets, magnets in the magnetic field of stationary currents.
10. Magnetic field strength, magnetic susceptibility and permeability. Magnetic field of a system of conductive currents in magnetics, boundary conditions at the interface of two magnets.
11. System of Maxwell's equations in the material environment and the conservation law of electromagnetic field energy. Quasi-stationary electromagnetic field.
12. Electromagnetic waves in homogeneous non-conductive medium, plane electromagnetic wave. Monochromatic plane wave and its polarization.
13. Refraction and reflection of a plane monochromatic wave at the interface of two media.

Recommended literature:

Kvasnica J.: Teorie elektromagnetického pole. Academia Praha, 1985.
Bobák A.: Teória elektromagnetického poľľa, UPJŠ Košice, 2002.
Bobák A., Vargová E.: Zbierka riešených úloh z elektromagnetického poľa, UPJŠ Košice, 2001.
Greiner W.: Classical Electrodynamics, Springer-Verlag, New York, 1998.

Course language:

1. Slovak,
2. English

Notes:

Course assessment

Total number of assessed students: 349

A	B	C	D	E	FX
26.36	8.88	19.2	20.92	16.91	7.74

Provides: doc. RNDr. Jozef Strečka, PhD.

Date of last modification: 19.09.2021

Approved: prof. Mgr. Daniel Jancura, PhD.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ TSF/17	**Course name:** Thermodynamics and Statistical physics
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: 4.	
Course level: I.	
Prerequisities:	
Conditions for course completion: To successfully complete the course, the student must demonstrate sufficient understanding of all the basic concepts and applications of thermodynamics and classical statistical physics within the syllabus of the course. Knowledge of basic concepts of thermodynamics and classical statistical physics at the level of their mathematical definition, as well as their physical content and principled applications is required. The student must be able to actively master the content of the curriculum continuously during the semester, so that he can actively and creatively use the acquired knowledge in solving specific problems during exercises and for independent homework. In addition to direct participation in lectures, the student is obliged to study within the self-study professional topics assigned by the teacher and also to develop and present two homework assignments. The condition for obtaining credits is, in addition to participation in lectures, also the successful completion of three written tests from exercises and lectures and the elaboration of home assignments. The minimum limit for passing the exam is to obtain 51% of the total score, which takes into account all required activities with relevant weight. Rating scale: A - 91% -100% points, B - 81% -90% points, C - 71% -80% points, D - 61% -70% points, E - 51% -60% points.	
Learning outcomes: After completing lectures and exercises, the student will acquire fundamental knowledge and skills in thermodynamics and classical statistical physics, which are prerequisites for completing advanced courses in quantum statistical physics, computer physics and condensed matter theory at the master's courses. The graduate of this course masters sufficient physical knowledge and mathematical apparatus to independently solve a wide range of current scientific problems in various fields of classical physics. These are mainly practical applications to systems consisting of a huge number of interacting particles described by the equations of classical physics. The graduate is able to apply the acquired knowledge in the field of life sciences (e.g. the spread of dangerous infectious diseases), but also in the field of big data processing and in the social and political sciences (e.g. prediction of election results).	
Brief outline of the course: 1. Historical introduction and basic concepts of thermodynamics. Macroscopic system and macroscopic parameters. Internal, external, extensive and intensive macroscopic parameters. State	

of system, state parameters and status functions. Basic division of thermodynamic systems - isolated, closed and open systems. Homogeneous and heterogeneous systems, thermaly homogeneous system. State of thermodynamic equilibrium. The first postulate of thermodynamics, transitivity and the principle of spontaneous inviolability of the equilibrium state.
2. The second postulate of thermodynamics and thermodynamic temperature. Natural, reversible, irreversible and quasi-static processes in thermodynamics. Internal energy, work and heat in thermodynamics. Thermal and caloric equation of state. The first law of thermodynamics. Heat capacity, specific and latent heat. Isothermal, isochoric, isobaric, adiabatic and polytropic processes in thermodynamics and their description.
3. Pfaff differential form, integrating factor, complete differential and their use in thermodynamics. Basic formulations of the second law of thermodynamics. Caratheodory's principle and mathematical formulation of the second law of thermodynamics for quasi-static processes. Introduction of absolute temperature and entropy in thermodynamics.
4. Relationship between thermodynamic and absolute temperature. Entropy and Claussius equation for reversible processes. Thermodynamic potentials for quasi-static processes. Maxwell's relations. The third law of thermodynamics. Unattainability of absolute zero temperature.
5. Dependence of thermodynamic quantities on the mass of the number of particles. Euler's theorem for homogeneous functions and its application. Thermodynamic potentials for systems with variable particle number. Non-static processes and nonequilibrium states. Slow and fast non-static processes. Mathematical formulation of the second law of thermodynamics for non-static processes. Clausius inequality.
6. Thermodynamic potentials of nonequilibrium systems and equilibrium conditions. Maximum work done by the body in the external environment. Heterogeneous systems. Gibbs phase rule.
7. Phase space, configuration space and impulse space. Statistical ensemble and distribution function. Stationary ensemble. Canonical invariance of phase volume. Calculation of mean values of physical quantities in classical statistical physics.
8. Microcanonical, canonical and grand canonical ensembles in classical statistical physics. Canonical and grand canonical partition function, internal energy, entropy, free energy and grand canonical potential.
9. Equipartition and virial theorems. Calculation of ideal gas entropy in a microcanonical ensemble, Gibbs paradox.
10. The ideal gas in the canonical ensemble and the classical theory of paramagnetism. Classical theory of heat capacity - Dulong's-Petit's law.

Recommended literature:

1) J. Kvasnica, Termodynamika, SNTL, Praha (1965).
2) J. Kvasnica, Statistická fyzika, ACADEMIA, Praha (1983).
3) M. Varady, Statisticka fyzika, UJEP Ústi nad Labem, 2007.
4) M. Jaščur, M. Hnatič, Úvod do termodynamiky, Univerzita P.J. Šafárika, Košice (2013).

Course language:

Notes:

Course assessment
Total number of assessed students: 33

A	B	C	D	E	FX
42.42	18.18	33.33	3.03	3.03	0.0

Provides: prof. RNDr. Michal Jaščur, CSc.

Date of last modification: 06.11.2021

Approved: prof. Mgr. Daniel Jancura, PhD.