CONTENT

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/PVS/04	**Course name:** Author's patents, discoveries, software
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** distance, present	
Number of ECTS credits: 2	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Patent filed, invention, software product created.	
Learning outcomes: The PhD student demonstrates the ability to create an innovative product in a given scientific field, or with impact on an interdisciplinary scale or in technical practice.	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 48	

abs	n
100.0	0.0

Provides:	
Date of last modification: 08.11.2022	
Approved: prof. RNDr. Pavol Sovák, CSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ UMV/BM/21	**Course name:** Biomaterials

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

Number of ECTS credits: 4

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
The student must demonstrate sufficient knowledge in the field of preparation and characterization of natural and synthetic biomaterials of various structural and material nature. The aim is to gain current knowledge about the material characteristics of biomaterials, methods of their synthesis and evaluation of properties, the nature of the microstructure and the interrelationships between material and biological properties. They will also obtain information on methods for testing biomaterials in vitro for their comprehensive evaluation.
Credit evaluation of the course takes into account the following student workload: direct teaching and self-study of recommended supplementary literature - 2 credits, elaboration of a ppt project on a selected topic - 1 credit, preparation for the test - 1 credit. The minimum limit for obtaining an evaluation for graduates of fields other than BM is 50% of each point evaluation from the test and the project. The allocation of project / test points is 60/40.

Learning outcomes:
The graduate will gain information about the material base, structure and properties of biomaterials and the basic methods of characterization of their properties. The mentioned knowledge in the case of a closer specialization in the issue of biomaterials will enable him to understand the context aimed at optimizing the necessary biological characteristics and also easier orientation in the issues studied in his own dissertation.

Brief outline of the course:
Synthetic biopolymers. Collagen and fibrous proteins. Tissue bonding materials. Bioceramics. Biocomposites. Biocements and fillers based on calcium phosphates and bioglasses. Basic physical properties, biodegradation of biomaterials, technologies of preparation and quality evaluation of biocements and biocomposites, phase formation and microstructure of biomaterials based on hydroxyapatite.

Recommended literature:
1. F.H.Silver: Biological Materials: Structure, mechanical properties, and modeling of soft tissues. NY University Press , 1987.
2. Biopolymers/Non-Exclusion HPLC:T.E.Lipatova: Medical Polymer Adhesives. Akademie-Verlag Berlin, 1987.

4. S. Ramakrishna a kol. : Biomedical applications of polymer-composite materials. Composites Sci. and Technology 61 (2001) 1189-1224.
5. J.F. Mano a kol.: Bioinert, biodegradable and injectable polymeric matrix composites for hard tissue replacement. Composites Sci. and Technology 64(6) (2004) 789-817.
6. F.H. Jones: Teeth and bones: Application of surface science to dental materials and related biomaterials. Surface Sci. Reports 42 (2001) 75-205.
6. S. S. Ray, M. Bousmina:Biodegradable polymers and their layered silicate nanocomposites.Progress in Materials Science 50 (2005) 962–1079.
7. C. Prati, M. G. Gandolfi:Calcium silicate bioactive cements:Biological perspectives and clinical applications.Dental Materials 31(2015) 351–370
8. A. Kolk, J. Handschel, W. Drescher, D. Rothamel, F. Kloss, M.Blessmann, M.Heiland, K.D. Wolff, R. Smeets:Current trends and future perspectives of bone substitute materials:>From space holders to innovative biomaterials.Journal of Cranio-Maxillo-Facial Surgery 40 (2012) 706-718

Course language:
Slovak or English

Notes:

Course assessment
Total number of assessed students: 0

N	P
0.0	0.0

Provides: RNDr. Ľubomír Medvecký, CSc.

Date of last modification: 07.10.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ KEM/14	**Course name:** Ceramics Materials

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: 1., 3.

Course level: III.

Prerequisities:

Conditions for course completion:
Test,
Examination

Learning outcomes:
The main aim of this course is to gain confidence in the preparation and properties of a wide range of ceramics and their applications.

Brief outline of the course:
Introduction to Solid State Science. The Fabrication of Ceramics. Construction Ceramics. Mechanical Properties of Construction Ceramics. Ceramics Conductors. Dielectrics and Insulators. Piezoeletrics Ceramics. Pyroelectric Materials. Electro-optic Ceramics. Magnetic Ceramics. Aplications of Ceramics Materials in a Modern Idustry.

Recommended literature:
1. Moulson A.J., Herbert J.M.: Electroceramics, Chapman and Hall, London, 1990.

Course language:
Slovak, English

Notes:

Course assessment
Total number of assessed students: 3

N	P
0.0	100.0

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

Date of last modification: 16.09.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ COK/22	**Course name:** Certified training course
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** distance, present	
Number of ECTS credits: 4	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Completion of a certified professional/training course.	
Learning outcomes: The PhD student acquires up-to-date scientific knowledge, develops the capabilities of scientific work and familiarizes himself with the methodologies of making scientific knowledge available. He confronts his own knowledge and skills with other course participants, develops the abilities of peer discussion in the given scientific field.	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 7	

abs	n
100.0	0.0

Provides:
Date of last modification: 08.11.2022
Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚCHV/ ZCVU/04	**Course name:** Chemical Engineering

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

Number of ECTS credits: 5

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

Course level: I., III.

Prerequisities:

Conditions for course completion:

Learning outcomes:

Brief outline of the course:
General and Inorganic Engineering; Mineral raw materials; Raw materials processing, transport and holding; Chemical reactors; Chemical metallurgy – Fe, Al, Cu working; Inorganic acids manufacture (H2SO4, HNO3, HCl, HF, H3PO4); Industrial electrochemistry; Industrial fertilizers; Silicate industry – cement manufacture, ceramics; Petrochemistry

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 22

A	B	C	D	E	FX	N	P
22.73	54.55	13.64	4.55	0.0	0.0	0.0	4.55

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

Date of last modification: 21.01.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚCHV/ CNM/15	**Course name:** Chemistry of nanomaterials

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

Number of ECTS credits: 5

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

Course level: III.

Prerequisities:

Conditions for course completion:

Learning outcomes:

Brief outline of the course:

Recommended literature:

Course language:

Notes:
The course is standardly realized in full-time form, in case of necessary circumstances by distance.

Course assessment
Total number of assessed students: 37

A	B	C	D	E	FX	N	P
62.16	18.92	5.41	0.0	0.0	0.0	0.0	13.51

Provides: prof. RNDr. Vladimír Zeleňák, DrSc.

Date of last modification: 21.11.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ CM/22	**Course name:** Citation in monograph
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** distance, present	
Number of ECTS credits: 8	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Obtained citation registered in SCI or Scopus.	
Learning outcomes: Obtaining a citation demonstrates broad and very well-founded scientific knowledge in the researched field, based on the ability to formulate research questions, to reflect on a scientific problem in such a way that generates new knowledge. At the same time, a citation in an indexed source demonstrates the competence to communicate new knowledge, which is a significant contribution to scientific knowledge, at the highest expert level.	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 0	

abs	n
0.0	0.0

Provides:
Date of last modification: 08.11.2022
Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ CZC/22	**Course name:** Citation in scientific journal published abroad

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

Number of ECTS credits: 4

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

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

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 8

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ CDC/22	**Course name:** Citation in scientific journal published in the country of residence
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** distance, present	
Number of ECTS credits: 2	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Records of citations in the central register of records of publication activity.	
Learning outcomes: A citation in a peer-reviewed scientific journal indicates the quality of a doctoral student's publication activity and the acceptance of his publishing activity in the domestic scientific community.	
Brief outline of the course: Study of literature with a focus on the chosen issue of publication output.	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 0	

abs	n
0.0	0.0

Provides:
Date of last modification: 12.10.2022
Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SCI/22	**Course name:** Citation registered in Science Citation Index
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** distance, present	
Number of ECTS credits: 8	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Records of citations in the central register of records of publication activity.	
Learning outcomes: A citation in a peer-reviewed scientific journal indicates the quality of a doctoral student's publication activity and the acceptance of his publishing activity in the scientific community.	
Brief outline of the course: Study of literature with a focus on the chosen issue of publication output.	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 93	

abs	n
100.0	0.0

Provides:
Date of last modification: 12.10.2022
Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/SPAV/22	**Course name:** Co-investigator of the applied research project

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

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Co-investigator of the applied research project

Learning outcomes:
The PhD student demonstrates the ability to participate in teamwork, to bring his own contribution to the solution of the project objective of applied research and to take responsibility for assigned tasks. By solving an applied research project, he acquires the ability to implement the project objective according to the established procedure, to follow the project schedule, to coordinate his own activities with colleagues, to participate in the creation of applied research outputs. The PhD student gains valuable experience from the practical course of a grant project with a focus on applied research.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 16

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ SIG/22	**Course name:** Co-worker of project supported by internal grant schemes (VVGS)

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

Number of ECTS credits: 3

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Co-worker of project supported by internal grant schemes (VVGS)

Learning outcomes:
The PhD student demonstrates the ability to participate in teamwork, to bring his own contribution to the solution of the project objective within the internal grant system at UPJŠ. By solving the internal VVGS grant, he acquires the ability to implement the project plan according to the established procedure, adhere to the project schedule, coordinate his own activities with colleagues, and participate in the creation of outputs. The PhD student gains valuable experience from the practical course of the grant project.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 16

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SMPR/04	**Course name:** Co-worker of project supported by international grant schemes
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** distance, present	
Number of ECTS credits: 15	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Membership in the research team of an international project.	
Learning outcomes: Active involvement by solving a specific task within a team of international project solvers. The PhD student demonstrates the ability to work in a team, take responsibility for the assigned task, adhere to the time schedule and fulfill the project outputs. The PhD student gains personal experience from the implementation of an international project, participation in its key stages, creation of measurable outputs, grant funding of science	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 129	

abs	n
100.0	0.0

Provides:	
Date of last modification: 08.11.2022	
Approved: prof. RNDr. Pavol Sovák, CSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SDPR/22	**Course name:** Co-worker of project supported by national grant schemes
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** distance, present	
Number of ECTS credits: 10	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Co-investigator of the domestic project	
Learning outcomes: The PhD student demonstrates the ability to participate in teamwork, to bring his own contribution to the solution of the project objective and to take responsibility for the assigned tasks. By solving the domestic project, he acquires the ability to implement the project intention according to the established procedure, to follow the project schedule, to coordinate his own activities with colleagues, to participate in the creation of outputs. The PhD student gains valuable experience from the practical course of the grant project.	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 45	

abs	n
100.0	0.0

Provides:	
Date of last modification: 08.11.2022	
Approved: prof. RNDr. Pavol Sovák, CSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ UMV/KRIP/21	**Course name:** Creep of materials with limited plasticity

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: 2., 4.

Course level: III.

Prerequisities:

Conditions for course completion:
For successful completion, student has to demonstrate adequate knowledge of the mechanisms of time-dependent plastic deformation in metals and ceramic materials with the emphasis on the differences in the mass transfer mechanisms and their influence on deformation kinetics. The student will also understand the main types of tests and measurement of creep properties of ductile and brittle materials. Master students would study the materials specified in the PhD thesis under the guidance of the supervisor and the result will be presented as a PowerPoint presentation of the project from the topic defined at the beginning of the course. Credits evaluation of the subject: lectures and individual study of recommended literature -3 credits, ppt project - 1 credit.

Learning outcomes:
PhD studnet will receive the information on basic creep mechanism in ductile and brittle materials, basic testing methods, evaluation of the data from the tests, compaison of high temperature properties of metallic and ceramic materials, lifetime prediction. This knowledge is necessary for the understanding of the relationships between microstructure and creepovou behavior of different materials and contribute the the scientific part of dissertation work.

Brief outline of the course:
The course consists of the subsequent topics
1. overview of the basic creep mechanisms.
2. the differences between creep deformation in metals and ceramics
3. role of cavitation mechanism
4. creep testing methods – in tension, compression, bending, evaluation, pros and cons of ceramic materials, practical applications.

Recommended literature:
1.H. Riedel Fracture at High Temperatures, Springer Verlag, Berlin 1987.
2.J. Čadek, Creep kovových materiálu, Academia, Praha, 1984
3. Poirier, J.-P. Creep of Crystals, Cambridge University Press, Cambridge, England (1995).
4. F. Lofaj, Tensile Creep Behavior in the Advanced Silicon Nitride, Material Science & Engineering A, 279 [1-2] (2000) 61-72.

Course language:

Slovak or English

Notes:
ectures can be done at presence form or online form using MS Teams. Education form is updated at the begining of the subject. All ppt presentations are accessible in LMS UPJŠ.

Course assessment
Total number of assessed students: 0

N	P
0.0	0.0

Provides: doc. RNDr. František Lofaj, DrSc.

Date of last modification: 23.09.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ODZP/14	**Course name:** Defence of Doctoral Thesis

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

Number of ECTS credits: 30

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

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

Learning outcomes:
The Dissertation thesis has elements of a scientific work and the student demonstrates extensive mastery of the theory and professional terminology of the field of study, acquisition of knowledge, skills and competences in accordance with the declared profile of the graduate of the field of study, as well as the ability to apply them in an original way in solving selected problems of the field of study. The student demonstrates the ability of independent scientific work in terms of content, formal and ethical aspects. Further details of the Dissertation thesis are determined by Directive no. 1/2011 on the essential prerequisites of final theses and by the Study Rules of Procedure at UPJŠ in Košice for doctoral studies.
The doctoral student demonstrated the ability and readiness for independent scientific and creative activity in the field of study of philology in accordance with the expectations of the relevant qualification framework and the profile of the graduate.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 134

N	P
0.75	99.25

Provides:
Date of last modification: 08.11.2022
Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ DDS/15	**Course name:** Domains and Domain Walls

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:

Course level: II., III.

Prerequisities:

Conditions for course completion:
To successfully complete the course, the student must demonstrate sufficient understanding of basic concepts of magnetism, anisotropy, statics and dynamics of domain structure. Knowledge of basic concepts is required. The student must be able to actively understand the content of the curriculum continuously during the semester, so that the acquired knowledge can be actively and creatively used in solving specific problems. 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 the lectures and the final evaluation, the student will demonstrate adequate knowledge of the course standard, which is defined by the brief content of the course and the recommended literature. Theoretical knowledge of the content of the subject allows him to fully participate in the further study of specialized subjects that are related to the assignment of his dissertation. Can find connections between the domain structure of the investigated materials in relation to their crystallographic structure, the method of their preparation or their thermal or mechanical processing. The acquired knowledge will also facilitate the performance of the scientific part of the dissertation.

Brief outline of the course:
Time schedule of the subject contents is updated in electronic board in AiS2 sw. The subject content is focused in the following main topics:
1. The concept of domain structure
2. Experimental techniques for the study of domain structure
3. Examples of domain structures - their calculation
4. Material parameters determining domain structure, anisotropies
5. Domain walls - types, calculations
6. Experimental techniques for the study of statics and dynamics of domain walls
7. Statics of a domain wall - its potential, critical field
8.-9. Domain wall dynamics - basic models and parameters determining DS dynamics.
10. Domain wall dynamics in small magnetic fields - DS dynamics in adiabatic mode.

11. Dynamics of the domain wall in high magnetic fields - structure of the domain wall, its changes, interaction with phonons
12. Maximum speed of the domain wall - Schlomann and Walker limit
13. Spintronics - application of domain wall promotion in spintronics (Race-Track memory, Logic based on domains and domain walls, sensors), current problems and the future.

Recommended literature:

1. B.D. Cullity, C.D. Graham, „Introduction to magnetic materials“, John Wiley & Sons, New Jersy (2009) 2. S. Chikazumi, Physics of Ferromagnetism, Oxford University Press, USA (2009) 3. S. Tumanski, Handbook of Magnetic Measurements, CRC Press (2011) 4. N. A. Spaldin, Magnetic Materials: Fundamentals and Device Applications, Cambridge University Press (2003)

Course language:
slovak, english

Notes:
Lectures can be done at presence form or online form using MS Teams. Education form is updated at the begining of the subject.

Course assessment
Total number of assessed students: 7

A	B	C	D	E	FX	N	P
71.43	0.0	28.57	0.0	0.0	0.0	0.0	0.0

Provides: prof. RNDr. Rastislav Varga, DrSc.

Date of last modification: 26.09.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ VPZP/22	**Course name:** Elaboration of reviewer report
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** distance, present	
Number of ECTS credits: 3	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Elaboration of reviewer report	
Learning outcomes: The PhD student demonstrates broad and scientifically based knowledge in the field of study, as well as knowledge of a wide range of methods and approaches. Demonstrates the ability to critically assess a professional problem and its proposed solution, as well as to evaluate it and possibly recommend another solution. He applies knowledge and skills from the field of pedagogical sciences to his own field.	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 0	

abs	n
0.0	0.0

Provides:
Date of last modification: 08.11.2022
Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

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

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

Number of ECTS credits: 2

Recommended semester/trimester of the course: 1.

Course level: III.

Prerequisities:

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

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

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

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

Course language:
English, level B2 according to CEFR

Notes:

Course assessment
Total number of assessed students: 780

N	Ne	P	Pr	abs	neabs
0.0	0.0	45.64	0.0	54.23	0.13

Provides: Mgr. Zuzana Kolaříková, PhD.

Date of last modification: 06.09.2024

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

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

Course assessment
Total number of assessed students: 774

N	Ne	P	Pr	abs	neabs
0.26	0.0	94.06	1.03	4.52	0.13

Provides: Mgr. Zuzana Kolaříková, PhD.

Date of last modification: 05.02.2024

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ DKZU/22	**Course name:** Home Conference with Foreign Participation

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

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

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

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 64

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ NEM/04	**Course name:** Implementation of new experimental methodology
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** distance, present	
Number of ECTS credits: 15	
Recommended semester/trimester of the course: 8.	
Course level: III.	
Prerequisities:	
Conditions for course completion:	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 100	

abs	n
100.0	0.0

Provides:
Date of last modification:
Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ZC/22	**Course name:** International Journal

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

Number of ECTS credits: 8

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

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

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 4

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ZSP1/22	**Course name:** International Study Stay less than 30 Days

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

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Completion of a foreign study stay lasting less than 30 days.

Learning outcomes:
By completing a shorter study stay, the PhD student demonstrates the ability to reflect on research problems and work critically with sources at an expert level and in an interdisciplinary context, while being able to generate new knowledge. He is able to actively communicate at an expert level in more than one language. He acts as a responsible independent scientist, works independently and in a group with the aim of pushing the boundaries of knowledge and transferring them to other areas of research, to practice and to the wider public. He can competently argue and explain his ideas.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 29

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ ZSP2/22	**Course name:** International Study Stay more than 30 Days

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

Number of ECTS credits: 10

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Completion of a foreign study stay lasting more than 30 days.

Learning outcomes:
By completing the study stay, the PhD student demonstrates the ability to reflect on research problems and work critically with sources at an expert level and in an interdisciplinary context, while being able to generate new knowledge. He is able to actively communicate at an expert level in more than one language. He acts as a responsible independent scientist, works independently and in a group with the aim of pushing the boundaries of knowledge and transferring them to other areas of research, to practice and to the wider public. He can competently argue and explain his ideas

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 12

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/MKZ/22	**Course name:** International abroad conference

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

Number of ECTS credits: 10

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

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

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 105

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ UNT1/99	**Course name:** Introduction to Low Temperature Physics

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: 1., 3.

Course level: III.

Prerequisities:

Conditions for course completion:
To successfully complete the course, a student who has not completed a master's degree in condensed matter physics (CMP) must, after completing the course, demonstrate sufficient knowledge of cryogenic techniques and properties of materials at low temperatures. Graduates of the CMP master's study will deepen this knowledge, under the guidance of the supervisor they will use this knowledge to study the materials that are the subject of the dissertation, for the overall evaluation they will develop a project on a selected topic. The credit evaluation of the course takes into account the following student workload: direct teaching - 1 credit, self-study of recommended supplementary literature + elaboration of a project or preparation for a test - 2 credits. The minimum limit for obtaining an evaluation for graduates of fields other than CMD is 50% of the point evaluation from the test. CMD graduates must obtain at least 50% points for the quality of the project.

Learning outcomes:
The aim of the course is to acquaint students with the basic properties of materials at low temperatures and the methods of obtaining and measuring low temperatures with emphasis on experimental experience and practical use. The acquired knowledge will help graduates of the Progressive Materials program in the preparation and study of new materials used in a wide range of cryogenic devices.

Brief outline of the course:
1. The concept of temperature. Temperature scales. Methods of measuring low and very low temperatures. Primary and secondary thermometers.
2. Cryogenic liquids. Properties and superfluidity of 4He and 3He.
3. Cryostats and refrigerators based on 4He and 3He. Adiabatic demagnetization of paramagnetic salts. Pulse tube refrigerators. Kapitza resistance.
4. Electrical conductivity of metals at low temperatures. Fermi gas of free electrons.
5. Basic properties of superconductors. Penetration depth. Coherence length. Classification of superconductors.
6. Phenomenological theory of superconductivity and basics of BCS theory. High temperature superconductivity.
7. Tunneling phenomena in superconductors. Quantum interference and SQUID.

8. Mesoscopic objects (Quantum Hall effect, ballistic transport, properties of 2D electron gas).
9. Heat capacity at low temperatures. Lattice and electron heat. Schottky's contribution. Heat capacity of superconductors and semiconductors.
10. Thermal conductivity of metals, electron and phonon component. Thermal conductivity of semiconductors, insulators and superconductors.

Recommended literature:

L. Skrbek a kol.: Fyzika nízkych teplôt, Matfyzpress, MFF KU Praha, 2011.
C. Enss, S. Hucklinger, Low-Temperature Physics, Springer, 2005.
A. Kent, Experimental low-temperature physics. Mac Millan Press Ltd., 1993.
D.S. Betts, An introduction to Milikelvin Technology. Cambridge University Press, 1989.
P.V.E. McClintok et al., Low-Temperature Physics. Blackie, Galsgow and London 1992.
F. Pöbell, Matter an Methods at Low Temperatures. Springer - Verlag, Berlin, 1992.
M. Tinkham, Introduction to Superconductivity, 2-nd edition, Mc Graw- Hill, New York 1996.
S. Takács, L.Cesnak, Supravodivosť, Alfa , Bratislava 1979
K. Fossheim, A. Sudbo, Superconductivity. Physics and Applications, John Wiley & Sons, Chichester, 2004.
J.F. Annett, Superconductivity, Superfluids and Condensates, Oxford University Press, Oxford, UK

Course language:
Slovak, English

Notes:
Teaching is carried out in person or on-line using MS Teams. Form of teaching specified by the teacher, updated continuously.

Course assessment
Total number of assessed students: 25

A	B	C	D	E	FX	N	P
72.0	8.0	0.0	0.0	0.0	0.0	0.0	20.0

Provides: doc. RNDr. Erik Čižmár, PhD.

Date of last modification: 21.09.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/DC/22	**Course name:** Local journal

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

Number of ECTS credits: 6

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

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

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 2

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ MVV1/07	**Course name:** Magnetic Materials with Outstanding Properties

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

Number of ECTS credits: 5

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

Course level: III.

Prerequisities:

Conditions for course completion:
To successfully complete the course, the student must demonstrate sufficient understanding of the basic phenomena in the field of magnetic materials. Knowledge of basic concepts of magnetism, its origin, properties and division of magnetic materials is required. During the semester, the student must continuously acquire selected magnetic materials, from their preparation to application. The condition for obtaining credits is the presentation of selected magnetic material together with an oral exam, which consists of theoretical questions. The credit evaluation of the course takes into account the following student workload: direct teaching (3 credits), preparation of the presentation (1 credit) and evaluation (1 credit).

Learning outcomes:
After completing the lectures, the student will gain a general overview of the magnetic properties of matter, various types of progressive magnetic materials and the application of soft and hard magnetic materials.

Brief outline of the course:
1.Magnetism of matter. Paramagnetism, diamagnetism, ferromagnetism and ferrimagnetism. 2. Macroscopic properties of ferromagnets. Domain structure. 3. Magnetic processes. Applications of soft magnetic materials. 4. Magnetic properties of iron-based alloys. 5. Magnetic losses and their separation. 6. Magnetic properties of cobalt and nickel based alloys and their applications. 7. Structure and magnetic properties of soft magnetic ferrites and their applications. 8. Structure and magnetic properties of hard magnetic ferrites and their applications. 9. Structure, preparation and magnetic properties of amorphous alloys. 10. Structure, preparation and magnetic properties of nanocrystalline alloys. 11. Magnetic particles, ferrofluids, magnetic cooling 12. Basic experimental methods of measuring magnetic materials.

Recommended literature:
S. Chikazumi: Physics of Magnetism, J.Willey and Sons, Inc. New York, London, Sydney, 1997.
D. Jiles: Introduction to magnetism and magnetic materials, Chapman&Hall, London, New York, Tokyo, Melbourne, Madras, 1991
R. C. O'Handley: Modern Magnetic Materials, Principles and Applications, J.Willey and Sons, Inc. New York, 1999, Modern scientific literature.

Course language:
slovak, english

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

Course assessment
Total number of assessed students: 47

N	P
0.0	100.0

Provides: doc. RNDr. Ján Füzer, PhD., RNDr. Ivan Škorvánek, CSc.

Date of last modification: 22.11.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ MKL/03	**Course name:** Magnetic Properties of Solids

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

Number of ECTS credits: 6

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

Course level: II., III.

Prerequisities:

Conditions for course completion:
To successfully complete the course (presence, if necessary distance) the student must demonstrate sufficient understanding of the concepts, phenomena and laws of magnetism of condensed matter, so that his knowledge of the physics of condensed matter is holistic. Knowledge of intrinsic magnetic properties of solids, types of energy, behavior of solids in a magnetic field and, in the case of ferromagnets and ferromagnets, also their domain structure is required. Knowledge of the basic use of magnetic materials in practice is also required.
Credit evaluation takes into account the scope of teaching (4 hours of lectures), evaluation (2 credits) and the fact that it is a profile subject that is part of the master's state exam. If the subject is included in the doctoral study of Progressive Materials, the fact that the subject is highly demanding for graduates of non-physical education is taken into account.
The minimum limit for successful completion of the course is to obtain 50 points in the oral exam from the subsequent point evaluation
Rating scale
A 100-91
B 90-81
C 80-71
D 70-61
E 60-50
Fx 49-0

Learning outcomes:
After completing the lectures and taking the exam, the student will have a deep knowledge of the magnetism of condensed matter and will have the ability to enter into a systematic theoretical and experimental solution of the problems of magnetism of condensed matter. He will also gain basic knowledge about the possibilities of using magnetic materials in technical practice.

Brief outline of the course:
l. week:
The classification of solids according to their magnetic properties. Classical diamagnetic, paramagnetic and ferromagnetic materials.
Magnetic quantities.

Magnetic moment. Orbital and spin momentum, orbital and spin magnetic moment.
2. week:
Atom with one electron and with more electrons. Hund's rules. Gyromagnetic experiments, resonance experiments.
The sources of magnetic fields (solenoid, toroid, Helmholtz coil, superconducting solenoid, electromagnet).
3. week:
The methods of measuring of the magnetic field. (Induction methods, fluxmeter method, magnetooptical effects, magnetoresistance, Hall effect, flux-gate method, SQUID method)
Diamagnetism. The classsical and Landau's diamagnetism. De Haas - van Alphen effect. Diamagnetism of superconductors.
4. week:
Paramagnetism.. The classical and quantum theory of paramagnetism. Pauli paramagnetism.
The methods of measuring the magnetic susceptibility of diamagnetics and paramagnetics. (Weiss method, torsion scales, Goy - Pascal scales).
5. week:
Ferromagnetism. Magnetization, Weiss theory of ferromagnetism. Exchange interactions. Curie temperature. Ferromagnetism of metals, alloys, rare earths and compounds.
6. week:
Thermal properties, thermal capacity, magnetocaloric effect and phase transitions.
Antiferromagnetism (structure, magnetization, susceptibility and Curie temperature).
7. week:
Ferrimagnetism (structure, spontaneous magnetization susceptibility to Curie and Neel temperature).
Study of spontaneous magnetic arrangement by neutron diffraction.
8. week:
Temperature dependence of spontaneous magnetic polarization, determination of Curie temperature (Extrapolation methods, line method of equal polarization, measurement of thermodynamic coefficients).
Energy of ferromagnets energy. (exchange, crystallographic magnetic anisotropy, magnetostriction, magnetoelastic, magnetostatic)
9. week:
Magnetic anisotropy.
Methods for measuring anisotropy constants (by measuring magnetization work, torsional anisometer).
Electrical resistance, Hall effect and magnetoresistance of ferromagnets.
10. week:
Domain structure of ferromagnets. Geometry and energy of domain walls. Primary and secondary domain structure.
Methods of domain structure monitoring (powder pattern method, magneto-optical phenomena, electron microscopy, X-ray method, ferromagnetic probe method).
11. week:
Magnetostriction, Villary effect.
Spontaneous magnetostriction. Magnetostriction of a monodomain particle, single crystals and polycrystalline substances.
Methods of measuring magnetostriction constants (strain gauge measurement, mechanical - optical, interference methods).
12. week:
Magnetization curves.

Demagnetizing effect of the sample. Magnetic circuit, yoke.
Basic ideas for the magnetization process. Elementary magnetization processes. Barkhausen phenomenon.
Methods for investigating the Barkhausen effect.
Mechanism of magnetic reversal, magnetic hysteresis, remanence and coercivity.
13. week:
Methods of recording the primary magnetization curve and the hysteresis loop (static and dynamic).
Premagnetization losses and methods of their measurement (wattmer, phase shift method, calorimetric, hysteresis loop area measurement).
Types of susceptibility of ferromagnetic substances (initial, maximum, reversible, irreversible, differential).
Measurement of susceptibility of ferromagnetic substances (Maxwell - Wien bridge, Owen bridge).

Recommended literature:

1. S. Chikazumi: Physics of Magnetism, J.Willey and Sons, Inc. New York, London, Sydney, 1997.
2. J. M. D. Coey: Magnetism and Magnetic Materials, Cambridge University Press, 2009
3. H. Kronmüller, S. Parkin - Handbook of Magnetism and Advanced Magnetic Materials, Wiley 2007
4. F. Fiorillo, Measurement and Characterization of Magnetic Materials, _Elsevier 2004
5. S. Tumanski, Handbook of Magnetic Measurements, CRC Press, 2011

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: 129

A	B	C	D	E	FX	N	P
37.21	13.95	10.85	3.88	2.33	3.88	2.33	25.58

Provides: prof. RNDr. Peter Kollár, DrSc.

Date of last modification: 22.11.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ MSA1/03	**Course name:** Methods of Structural Analysis

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: 7

Recommended semester/trimester of the course: 2.

Course level: I., II., III.

Prerequisities:

Conditions for course completion:
For successful completing of the subject student has to show after taking exam adequate knowledge from the area using sophisticated research infrastructure for structural analysis of solids. Content of the subject is focused study of structure analytical methods as TEM, SEM, STEM and X-ray techniques. Credits evaluation takes into account taking part at the lectures - 3credits, study of recommended literature -1credit, working out of experimental protocol from OM and EM -2 crediдts and study of recommended literature -2 credits, 2 credits – project, 1 credit – study for 2 written tests (EM and X-ray) - 1 credit. Minimal value to obtain evaluation for is reach 50% of each evaluation (tests and project) points. Point ratio protocol/test EM/TEST X-ray is 40/30/30.

Learning outcomes:
Student due to lecrures and experimental work after final exam demonstrates that he/she meets expectations according to the standards of the subject, which is predicted by short content andreferences. Student is able to use modern methods for structural analysis of metals. He has experiences with optic microscopy, electron microscopy (TEM, SEM, STEM),electron microprobe analysis and X-ray diffractometry.

Brief outline of the course:
Optic microscopy. Electron microscopy: Electron beam instruments, Electron optics, Electron lences and deflection systems, Transmission electron microscopy - principle and construction. Electron – specimen interactions. Electron diffraction. Kikuchy lines. Scanning electron microscopy – principle and cnstrucion. Scanning transmission electron microscopy. High Voltage electron microscopy. Electron microprobe analysis: WDX spectrometer, EDX spectrometer, Auger electron spectrometer. Self-emision microscopy. Convergent beam diffraction.
X-ray diffractometry: Scattering of x-rays, Neutrons and neutron scattering, CW - diffractometer, Ewald´s sphere, Diffraction on powder samples, The main characteristics of powder diffraction pattern, Structure factor, Ocupation factor, Atomic displacement factor, Peak intensity, shape and symmetry, Sherrer equation. Peak profile, Rietweld method. Qualitative phase analysis, parameters of elementary cell, Profile analysis of diffraction peak and interpretation of profile analysis.

Recommended literature:
1. P.W. Hawkes, J.C.H. Spence, Science of Microscopy, Springer, 2007, ISBN: 10:0-387-25296-7.

2. Vitalij Pecharsky, Peter Zavalij, Fundamentals of Powder Diffraction and Structural characterization of Materials, Publisher: Springer (March 3, 2005)
ISBN-10: 0387241477, ISBN-13: 978-0387241470
3. Jens Als-Nielsen, Des McMorrow, Elements of Modern X-ray Physics, Publisher: Wiley; 2 edition (April 4, 2011),ISBN-10: 0470973943, ISBN-13: 978-0470973943.
4. Current Publications in the field of TEM, REM, X-ray
5. M.D. Graef, M.E. Henry, Structure of Materials, Cambridge Univ. Press, 2012, ISBN:978-1-107-00587-7.
6. S. Amelinckx, D. Dyck, et al, Electron Microscopy - Principle and Fundamentals, VCH, 1997, ISBN: 3-527-29479-1.

Course language:
1. English

Notes:
Lectures can be done at presence form or online using MS Teams. Education form is updated at the begining of the subject. All ppt presentations are accesible in LMS UPJŠ.

Course assessment
Total number of assessed students: 95

A	B	C	D	E	FX	N	P
38.95	22.11	7.37	1.05	0.0	0.0	0.0	30.53

Provides: prof. RNDr. Pavol Sovák, CSc., Ing. Vladimír Girman, PhD., Mgr. Maksym Lisnichuk, PhD., RNDr. Jozef Bednarčík, PhD., univerzitný docent

Date of last modification: 21.09.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ MMTL/04	**Course name:** Modern Methods of Solids Structure Investigation

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

Number of ECTS credits: 5

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

Course level: III.

Prerequisities: ÚFV/MSA1/03

Conditions for course completion:
For successful completing of the subject student have to show after taking exam adequate knowledge from the area using sophisticated research infrastructure for structural analysis of solids. Content of the subject needs previous study of structure analytical methods as TEM, SEM, STEM and X-ray techniques. After pathing the course student is able to design experiment in X-ray laboratory or at large scale facility (LSF) like XFEL and DESY in Hamburg, ESRF Grenoble, JRN Dubna, ILL Grenoble. To be avaluated student have to path though written exam and to defend ppt project or scientific proposal for LSF. To achieve final evaluation, he/she has to work out ppt project dealing with the topic selected on the beginning of the course. Credits evaluation takes into account taking part at the lectures and study of recommended literature -2 credits, 2 credits – project, 1 credit – study for written test. Minimal value to obtain evaluation for other graduates is reach 50% of each evaluation (test and project) points. Point ratio project/test is 60/40. CMP graduates have to reach as minimum 50% points from the project. Participation at Scientific school for XFEL and synchrotron users “SFEL” is also recommended and it can substitute a proposal.

Learning outcomes:
After completing the lectures and after working out the proposal and taking the written test, the student will have a deep knowledge which allow her/him to find relationships between structure and physical properties of metals and also will have the ability to enter into a systematic theoretical and experimental solution of the problems of structural analysis. Student is also able to design experiment in X-ray laboratory or at large scale facility like XFEL and DESY in Hamburg, ESRF Grenoble, JRN Dubna, ILL Grenoble

Brief outline of the course:
Time schedule of the subject content is updated in electronic board in AiS2 sw. The subject content is focused in the following main topics:
New trends in Electron microscopy and Electron diffraction. State of art in Electron microprobe analysis: WDX spectrometer, EDX spectrometer, Auger spectroscopy. Modern electron diffracion methods (CBD, nanodiffraction), X-ray diffractometry, phase and profile analysis. Synchrotron radion: sources and application of SR in material science research, neutron scattering , Small angle scattering. Modern methods of surface observation: STM, AFM. Synchrotron radiation in material science research.

Recommended literature:

1.S. Amelincks, D.van Dyck, J. van Landyut, Electron Microscopy – Principles and Fundamentals, VCH, 1997.
2.M.H. Loretto, Electrom beam analysis of materials. Springer, 2002.
3.Fundamentals of Powder Diffraction and Structural Characterization of Materials, Vitalij K. Pecharsky & Peter Y. Zavalij , Kluwer Academic Publishers, 2003.
4.Structure Determination from Powder Diffraction Data, Edited by W.I.F. David, K. Shankland, L.B. McCusker, C. Bärlocher, Oxford University Press, 2006

Course language:

English

Notes:

Lectures can be done at presence form or online using MS Teams. Education form is updated at the begining of the subject. All ppt presentations are accesible in LMS UPJŠ.

Course assessment

Total number of assessed students: 76

N	P
0.0	100.0

Provides: prof. RNDr. Pavol Sovák, CSc., RNDr. Jozef Bednarčík, PhD., univerzitný docent

Date of last modification: 15.09.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ MONB/22	**Course name:** Monograph

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

Number of ECTS credits: 20

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Co-author of the monograph.

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ MONA/22	**Course name:** Monograph in a renowned publishing house

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

Number of ECTS credits: 40

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Co-author of a monograph in a renowned publishing house.

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 0

abs	n
0.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ NANO/09	**Course name:** Nanomaterials and Nanotechnologies

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

Number of ECTS credits: 4

Recommended semester/trimester of the course: 2.

Course level: II., III.

Prerequisities:

Conditions for course completion:
To successfully complete the course, the student must demonstrate sufficient knowledge of foundations of nanomaterials and nanotechnologies.
The credit evaluation of the course takes into account the following student workload:
1 credits: direct teaching and self-study of recommended supplementary literature,
3 credits: successful completion of an exam, which consists of a written test and a presentation on a selected topic in the field of nanomaterials.

Learning outcomes:
After completing lectures and exercises, the student will gain a comprehensive view of the properties of nanomaterials and their wide application.
The result of education is:
a) Complementing and summarizing knowledge in the field of distribution of nanomaterials and nanotechnologies.
b) Overview of methods for characterization of modern materials. suitable for practical applications.
c) Creation of the necessary terminological and knowledge base for mastering related subjects.

Brief outline of the course:
The course will provide information on nanomaterials in a clear and illustrative way in the following structure
Week 1: Definition, history, present and future of nanotechnologies. Basic concepts and metrology in nanotechnologies.
Week 2: Nanomaterials in 1D dimensions: thin films, thin films and surfaces; nanomaterials in 2D dimensions: carbon nanotubes, inorganic nanotubes, nanowires, biopolymers, nanomaterials in 3D dimensions: nanoparticles, fullerenes, dendrimers, quantum points.
Week 3: Preparation of nanomaterials. Preparation of nanomaterials by bottom-up techniques: chemical syntheses (micelle method, reverse micelle method, sol-gel method, precipitation), self-assembly, controlled assembly: CVD method (chemical vapor deposition), MBE method (molecular beam epitaxy).
Week 4: Preparation of nanomaterials by top-down techniques: cutting, grating, etching, lithography, SPD (spark plasma deposition).

Week 5: Technical applications of nanomaterials in microelectronics, cosmetics, textiles, automotive, textiles, construction. Risks of using nanomaterials and nanotechnologies: harmful impact on the environment, health and safety.
Week 6: Magnetic nanomaterials. Characterization of structural properties of nanomaterials: XRD, TEM, HRTEM, XANES, EXAFS.
Week 7: Physical properties of nanomaterials. Quantum effect of particle size, quantization of magnetization, effect of monodomain particles.
Week 8: The phenomenon of superparamagnetism in magnetic nanomaterials. Behavior of spin glass, comparison of theoretical models and experiment.
Week 9: Magnetic nanomaterials in biotechnology and nano-medicine: drug carriers, DNA chips, materials for MRI (magnetic resonance imaging), nanomaterials in the treatment of cancer.
Week 10: Magnetic nanomaterials for industrial catalysis and gas separation: nanoparticles in ordered porous matrices.
Week 11: Magnetic nanomaterials in information-telecommunication technologies and optoelectronics: computer chips, high-density recording media, hard disks, memories, sensors, quantum cryptographs, photon crystals for quantum computers.
Week 12: Nanomagnetic models. Modeling of physical and structural properties of magnetic nanomaterials.
Week 13: Exam

Recommended literature:

1. Nanoscience and nanotechnologies, The Royal Society, London 2004.
2. C. Burda, X. Chen, et al., Chemical Review 105, (2005) 1025-1102.
3. J. A. Mydosh, Spin glasses, Taylor and Francis 1993.

Course language:
english

Notes:
Lectures can be done at presence form or online form using MS Teams. Education form is updated at the begining of the subject.

Course assessment
Total number of assessed students: 52

A	B	C	D	E	FX	N	P
36.54	0.0	0.0	0.0	0.0	0.0	0.0	63.46

Provides: doc. RNDr. Adriana Zeleňáková, PhD.

Date of last modification: 30.09.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/DK/04	**Course name:** National Conference

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

Number of ECTS credits: 2

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

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

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 183

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ UMV/MAT/21	**Course name:** New materials and technologies

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: 2., 4.

Course level: III.

Prerequisities:

Conditions for course completion:
To successfully complete the course, students who have not completed the Condensed Matter Physics (CMP) master's degree must, after completing the course, demonstrate sufficient knowledge of the structure and properties of solids, concepts of precipitation and dispersion strengthening, composites with the addition of 1D and 2D nano- and microobjects. Students will gain basic knowledge about the evaluation of parameters of heterogeneous structures, the preparation of unconventional materials, the effects of the structures and interfaces on the resulting mechanical properties. Graduates of the CMP master's study, under the guidance of the supervisor, will focus on the properties of the materials that are the subject of their dissertation and for the overall evaluation will prepare a ppt project on the assigned topic at the beginning of the semester. Credit evaluation of the course takes into account the following student workload: direct teaching/consultations and self-study of recommended supplementary literature - 1 credit, elaboration of a ppt project on a selected topic - 2 credits, preparation for the test - 1 credit. The minimum limit for obtaining an evaluation for graduates of fields other than CMP is 50% of each point evaluation from the test and the project. The allocation of project / test points is 60/40. FKL graduates must obtain at least 50% points for the quality of the project.

Learning outcomes:
After completing consultations and self-study, based on the project and the final evaluation, the students will demonstrate adequate knowledge of the course content standards, which are defined by the brief content of the course and the recommended literature. Theoretical understanding of the subject content allows them to fully participate in the further study of specialized subjects that are related to the assignment of the dissertation. The doctoral students will gain an overview of the preparation, structure and properties of new materials, non-traditional structures, the specifics of their processing. They are able to find connections between the physical properties of investigated materials in relation to their microstructure. The acquired knowledge will also facilitate the performance of the scientific part of the dissertation.

Brief outline of the course:
The time schedule of the course content is updated in the electronic bulletin board in AiS2 sw. The subject content is focused on the following main topics:
1. Theory of reinforcement.

2. Homogeneous and heterogeneous structures. Parameters of heterogeneous structures.
3. Preparation of unconventional materials.
4. Mechanical properties and failure of metals and intermetallics based composites.
5. "In situ" failure models.
6. Analysis of phases and interfaces.
7. Creep behavior of selected materials.

Recommended literature:

1. Hrivňák I.: Nové materiály a technológie. TU Košice, 1998
2. Besterci M.: Dispersion strengthened Al prepared by mechanical alloying. Cambridge Int. Sci Publ. 1999
3. Saxl et al.: Quantification and modelling of heterogeneous systems. Cambridge Int. Sci Publ.1995
4. Ceramic nanocomposites, Ed. Rajat Bannerjee. Cambridge: Woodhead Publishing, 2013. ISBN 978-0-85709-338-7.

Course language:
English

Notes:
Lectures can be done at presence form or online form using MS Teams. Education form is updated at the begining of the subject.

Course assessment
Total number of assessed students: 1

N	P
0.0	100.0

Provides: doc. RNDr. Pavol Hvizdoš, DrSc.

Date of last modification: 22.09.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ NKM1/99	**Course name:** Non-Conventionals Metallic Materials

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: 1., 3.

Course level: II., III.

Prerequisities:

Conditions for course completion:
For successful graduation of the subject student has to demonstrate relevant theoretical knowledge at final exam. Credit evaluation is composed of following parts: Taking part at the lectures – 1 credit, Self-study of recommended literature – 1 credit, Final exam – 1 credit. The final exam consist of written answers and oral discussion. The rating scale is determined as follow: A (90-100%), B (80-89%), C (70-79%), D (60-69%), E (50-59%), F (0-49%). Any changes related to form of teaching or in condition of subject completion will be communicated in the electronic board of the course.

Learning outcomes:
Student gain knowledge of fundamental theories of materials science, processing of metallic materials, essential knowledge and an overview about conventional and advanced metallic materials. The relationship between structure and physical/chemical/mechanical properties will be emphasized. Student earn the knowledge of modern practical applications of selected metallic alloys, mainly based on Fe, Ti, Al, Ni and Co. The principles and using of materials phenomena as well as methodology of new alloy designing will be significant part of acquired knowledge too.

Brief outline of the course:
Real metalic structures, Binary diagrams, Lattice imperfections, Hyperstructures, Streghtening mechanisms, Precipitation and segregation processes, Deformation mechanisms, Crystallization, Fe - based alloys, Advanced high-strenght alloys, Metallic biomaterials, Corrosive processes and materials for corrosion environment. Ti, Al, Co, Ni - based progressive materials, Materials dedicated to automotive, aircraft, military and nuclear industry, Superplasticity, Shape memory effect and its alloys, Materials for cryogenic applications, Intermetallics, Quasicrystals, High entropy alloys, Biodegradable metals, Metallic glasses.

Recommended literature:
W. D. Callister Jr., D. G. Rethwisch, Materials Science and Engineering: An Introduction, 10th Edition, ISBN 978-1-119-40549-8, (2018).
R. Moravčík et al.: Úvod do materiálového inžinierstva I., ISBN 978-80-227-4405-8, (2015).
L. Ptáček et al.: Náuka o materiálu I a II, ISBN 8072042483, (2002).
Š. Nižník: Základy Fyziky tuhých látok, Učebné texty, Košice, (2002).
M. Fujda: Základné rovnovážne diagramy, Učebné texty, košice, (2010).

Course language:
Slovak language, English language

Notes:
Lectures are conducted in the presence form. In case of any circumstances, the lectures are turned to online form in specified communication platform.

Course assessment
Total number of assessed students: 42

A	B	C	D	E	FX	N	P
28.57	21.43	0.0	2.38	2.38	0.0	0.0	45.24

Provides: Ing. Vladimír Girman, PhD.

Date of last modification: 01.12.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/NRZ/22	**Course name:** Non-Reviewed International or National Proceedings

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

Number of ECTS credits: 2

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

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

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 18

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ OVTL/21	**Course name:** Optical properties of solids

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: 4.

Course level: II., III.

Prerequisities:

Conditions for course completion:
To successfully complete the course, the student must demonstrate sufficient knowledge of the optical properties of solids, taking into account the knowledge defined in the course syllabus.
The credit evaluation of the course takes into account the following student workload:
1 credits: direct teaching and self-study of recommended supplementary literature,
3 credits: exam in the form of an oral exam and a test.

Learning outcomes:
Students will gain knowledge in the field of optical properties of solids, with regard to the following knowledge: Optical properties of isotropic materials: Dielectric function of crystals, Symmetry of dielectric tensor, Neumann principle. Optical properties of anisotropic materials: Light propagation in anisotropic media, birefringence, optical activity, inversion center, calculation of counterclockwise and clockwise circularly polarized waves. Crystal symmetry from the perspective of optics. Distribution of crystals according to symmetry and from the point of view of anisotropy. Polarization catastrophe: Difference between local and macroscopic field, Clausio-Mossotti equation. Optical properties of ionic crystals: Susceptibility of ionic crystals, Dielectric function of ionic crystals, Collective modes in ionic crystals, Lyddan-Sachs-Teller (LST) relation, Ferroelectric instability.
Spontaneous and stimulated emission, Quantum theory of light, Luminescence in systems with localized electrons, fluorescence, Franck-Condon effect, luminescence in systems with delocalized electrons. Light scattering and photoemission: Rayleigh scattering, extinction length, critical opalescence, Optical fibers. Raman scattering: Stokes frequency, Selection rules for Raman scattering, Brillouin scattering. Photoemission: principle, presentation of angularly resolved photoemission experiments (ARPES) and their use for characterization of solids. Surface plasmon resonance (SPR) in nanosystems. Experimental methods based on dynamic light scattering. Experimental optical methods for characterization of solids.

Brief outline of the course:
1. Introduction lecture - reminder of terms: Optical constants, Description of the interaction of solids with light (Maxwell's theory, Lorentz-Drude microscopic theory, Semiclassical approach, Quantum description of interaction, Spintronics).

2. Optical properties of isotropic materials: Dielectric function of crystals, Symmetry of dielectric tensor, Optical frequencies, Neumann principle.
3. Optical properties of anisotropic materials: Light propagation in anisotropic media, birefringence, optical activity, inversion center, calculation of counterclockwise and clockwise circularly polarized waves.
4. Symmetry of crystals from the point of view of optics. Distribution of crystals according to symmetry and from the point of view of anisotropy. Polarization catastrophe: Difference between local and macroscopic field, Clausio-Mossotti equation.
5. Optical properties of ionic crystals: Susceptibility of ionic crystals, Dielectric function of ionic crystals, Collective modes in ionic crystals, Lyddan-Sachs-Teller (LST) relation, Ferroelectric instability.
6. Luminescence I: Spontaneous and stimulated emission, Quantum theory of light, Luminescence in systems with localized electrons, fluorescence
7. Luminescence II: Franck-Condon phenomenon, luminescence in systems with delocalized electrons.
8. Light scattering and photoemission: Rayleigh scattering, extinction length, critical opalescence, Optical fibers.
9. Raman scattering: Stokes frequency, Selection rules for Raman scattering, Brillouin scattering.
10 Photoemission: principle, presentation of angularly resolved photoemission experiments (ARPES) and their use for characterization of solids.
11. Surface plasmon resonance (SPR) in nanosystems: principle, practical application and demonstrations of experimental measurements using UV VIS method in the laboratory.
12. Experimental methods based on dynamic light scattering: measurement of nanoparticle size and surface charge (Zetapotential). Principle of the method and demonstrations in the laboratory.
13. Experimental optical methods for characterization of solids: Basics of FT-IR spectroscopy, Basics of Raman spectroscopy, ultrafast photoemission method, time-resolved optical microscopy.
14. Consultations, pre-term of the exam.

Recommended literature:

1. Fox M., Optical Properties of Solids, Oxford, 2001
2. Jan Soubusta, Antonín Černoch, Optical properties of solids, Palacky University, 2014.
3. R. Hlubina, Electrical and optical properties of solids, Komensky University 2018.

Course language:
english

Notes:
Lectures can be done at presence form or online form using MS Teams. Education form is updated at the begining of the subject. All ppt presentations are accesible in LMS UPJŠ.

Course assessment
Total number of assessed students: 6

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

Provides: doc. RNDr. Adriana Zeleňáková, PhD.

Date of last modification: 21.11.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

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

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

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

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

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

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

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

Recommended literature:

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

Course language:
slovak

Notes:

Course assessment
Total number of assessed students: 121

abs	n	neabs
98.35	0.0	1.65

Provides: doc. PaedDr. Renáta Orosová, PhD.

Date of last modification: 14.09.2024

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ FCVM1/13	**Course name:** Physical and chemical properties of materials 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: 5

Recommended semester/trimester of the course: 1.

Course level: III.

Prerequisities:

Conditions for course completion:
For successful completing of the subject student who didn't graduate Condensed Matter Physics (CMP) at 2 st. of study have to after taking exam show adequate knowledge's from area of structure and properties of solids, physical metallurgy with special accent to thermodynamics of phase transition, physics of materials and properties of steels and selected nonferrous metals. CMP graduate under guidance his/her supervisor have to study physical properties of material which is subject of his dissertation. To achieve final evaluation, he/she has to work out ppt project dealing with the topic selected on the beginning of the course. Credits evaluation takes into account taking part at the lectures and study of recommended literature -2 credits, 2 credits – project, 1 credit – study for written test. Minimal value to obtain evaluation for other graduates (non CMP) is reach 50% of each evaluation (test and project) points. Point ratio project/test is 60/40. CMP graduates have to reach as minimum 50% points from the project.

Learning outcomes:
After completing the lectures and taking the written test, the student will have a deep knowledge which allow her/him to find relationships between structure and physical properties of metals and also will have the ability to enter into a systematic theoretical and experimental solution of the problems of physical metallurgy. He will also gain basic knowledge about the possibilities of using steels and nonferrous metals in technical practice.

Brief outline of the course:
Time schedule of the subject contents is updated in electronic board in AiS2 sw. The subject content is focused in the following main topics:
Basic principles of Crystallography.
1. Diffraction phenomena in crystals. Structure and atomic factor. X-ray diffraction methods.
2. Mechanical properties of solids.
3. Thermal and Electrical properties of solids.
4. Basic principles of Physics of materials: dislocations, mechanisms of strengthening and hardening. Structure of pure metals, solid solutions, intermetallic compounds.
5. Basic principles of Physical Metallurgy - thermodynamics of phase transition. Phase diagrams. Diffusion in metals and compounds. Phase transformation - solidification and precipitation.
6. Physical metallurgy of steels.

7. Fe-Fe3C binary system, classification and properties of steels
8. Production, properties and applications of selected non-ferrous metals Al, Ni, Cu, Co, Sn…

Recommended literature:

1. R.W. Cahn and P. Haasen, Physical Metalurgy, ISBN 0 444 86786 4 part I, NHPandC, 1983.
2. M.A. White, Physical Properties of Materials, CRC Press 2012, ISBN:978-1-4398-6651-1
3. R. Oganov, Modern Methods of Crystal structure Prediction, Wiley-VCH, 2011, ISBN: 978-3-527-40939-6.
4. M.A.Mayers et al: Nano and Microstructural Design of Advanced Materials, Elsevier 2003, ISBN:0-08-044373-7.
5. Donald R. Askeland, Pradeep P. Fulay, Wendelin. Wright, The Science and Engineering of Materials, Cengage Learning 2011, sixth edition, www.cengage.com/engineering ISBN 13:978-0-495-29602-7.

Course language:
english

Notes:
Lectures can be done at presence form or online form using MS Teams. Education form is updated at the begining of the subject. All ppt presentations are accesible in LMS UPJŠ.

Course assessment
Total number of assessed students: 40

N	P
0.0	100.0

Provides: prof. RNDr. Pavol Sovák, CSc., doc. Ing. Karel Saksl, DrSc.

Date of last modification: 29.09.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ FCVM2/13	**Course name:** Physical and chemical properties of materials II

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

Number of ECTS credits: 5

Recommended semester/trimester of the course: 2.

Course level: III.

Prerequisities:

Conditions for course completion:
To successfully complete the course, the student must demonstrate sufficient knowledge of the basics of nanomaterials and nanotechnologies with emphasis on the basic concepts and classification of nanomaterials, procedures for preparing nanomaterials, the origin of nanomagnetism based on derivation from thermodynamic principles, magnetic nanomaterials. Fundamentals of chemical syntheses and properties of porous nanomaterials. Applications of nanomaterials in energy, biomedicine, industry.
The credit evaluation of the subject takes into account the following student workload:
2 credits: direct teaching and self-study of recommended supplementary literature,
2 credits: elaboration of a presentation from the assigned topic of the subject content, which is related to the topic of the dissertation,
1 credit: independent preparation for the final test and its successful completion.

Learning outcomes:
AAfter completing the lectures and presentation of the project and successful completion of the final test, the student will demonstrate adequate achievement of the content standard of the course, which is defined by the brief content of the course and the recommended literature. The result of education is:
a) Complementing and summarizing knowledge of mechanical, physical and chemical properties of progressive and nanomaterials.
b) Characterization and research of modern materials suitable for practical applications.
c) It creates the necessary terminological and knowledge base for mastering the related compulsory elective subjects.

Brief outline of the course:
The course will provide clear and clear information on the separation of nanomaterials in terms of size (thin films, thin films and surfaces; carbon nanotubes, inorganic nanotubes, nanowires, biopolymers, nanoparticles, fullerenes, dendrimers, quantum dots), in terms of preparation methods and in terms of their application use. Physical and chemical properties and characterization of nanomaterials (XRD, TEM, HRTEM, XANES, EXAFS, magnetic properties) will be discussed in more detail. From the application use we focus on the use of nanomaterials in biotechnology and nano-medicine (drug carriers, DNA chips, materials for MRI, nanomaterials in cancer treatment,

for industrial catalysis and gas separation and in information and telecommunication technologies and optoelectronics as quantum cryptographs and photon crystals Students will get acquainted with the use of adsorption for the use of nanomaterials for the capture and storage of CO2 and H2, with emphasis on nanomagnetism, the origin of nanomagnetism and specific nanoscopic magnetic phenomena.

Recommended literature:

1. F.J. Owens and CH. P. Poole, Physics and Chemistry of nanosolids, , Physical Metalurgy, ISBN 978-0-470-06740-6, Wiley, 2008.
2. X. Fang, Innovative Nanomaterials, ISBN 13-978-981-4303-89-7,Stanford Ltd., 2012.
3. R. Camley, Z. Celinski, R. Stamps, Magnetism of Surfaces, Interfaces and Nanoscale Materials, ISBN: 978-0-444-62634-9, Elsevier 2016.
4. M.A.Mayers et al: Nano and Microstructural Design of Advanced Materials, Elsevier, 2003, ISBN:0-08-044373-7.

Course language:
english

Notes:
Lectures can be done at presence form or online form using MS Teams. Education form is updated at the begining of the subject. All ppt presentations are accesible in LMS UPJŠ.

Course assessment
Total number of assessed students: 40

N	P
0.0	100.0

Provides: doc. RNDr. Adriana Zeleňáková, PhD., prof. RNDr. Vladimír Zeleňák, DrSc.

Date of last modification: 30.09.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ FMJ/06	**Course name:** Physics of Magnetic Phenomena

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: 1., 3.

Course level: III.

Prerequisities:

Conditions for course completion:
To successfully complete the course, the student must demonstrate sufficient knowledge of the basics of magnetism with emphasis on the origin of the magnetic moment, the basic classification of magnetic materials and the cause of the domain structure. At the same time, the student must demonstrate sufficient knowledge about basic magnetization processes and the magnetization processes in various types of materials, dynamics of magnetization processes (dynamics of domain wall movement, rotation of magnetization vector), magnetic hysteresis and magnetic measurements.
The credit evaluation of the course takes into account the following student workload:
2 credits: direct teaching and self-study of recommended supplementary literature,
1 credit: independent preparation for the final test and its successful completion.
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 the lectures and successfully passing the final test, the student will demonstrate adequate konowlage of the standard content of the course, which is defined by the brief content of the course and the recommended literature. The result of education is:
a) Creation of the necessary terminology and knowledge base for understanding the nature of magnetic phenomena.
b) Characterization and research of magnetic materials suitable for practical applications.
c) Complementing and summarizing knowledge in the field of magnetism, magnetic materials and magnetization processes.

Brief outline of the course:
The course will provide clear and illustrative information about the history of magnetism, the basic quantities characterizing magnetic materials and magnetic phenomena. It informs about the origin of the magnetic moment and on the basis of various magnetic properties it divides materials into dia-, para-, ferri, antiferero- and ferromagnetic materials. This course informs about the basic magnetic anisotropies, the domain structure and magnetization processes taking place in various materials. From the application and experimental point of view, the course deals with the description

of the dynamics of magnetization processes (domain wall dynamics, rotation of the magnetization vector), basic magnetic measurements and magnetic hysteresis.

Recommended literature:

1; B.D. Cullity and C.D. Graham, Introduction to magnetic materials, Willey-IEEE Press, 2007
2; S. Chikazumi, Physics of Ferromagnetism, Claredon Press, 1997
3; C.W. Chen, Magnetism and metallurgy of soft magnetic materials, Dover Publ.,1986

Course language:

slovak or english

Notes:

Lectures can be done at presence form or online form using MS Teams. Education form is updated at the begining of the subject.

Course assessment

Total number of assessed students: 67

A	B	C	D	E	FX	N	P
59.7	4.48	1.49	1.49	0.0	0.0	0.0	32.84

Provides: RNDr. Ladislav Galdun, PhD., prof. RNDr. Rastislav Varga, DrSc.

Date of last modification: 27.09.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ POP/22	**Course name:** Popularisation of science

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

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

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

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 66

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚCHV/ ADP/03	**Course name:** Porous materials and their applications

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

Number of ECTS credits: 5

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

Course level: I., II., III.

Prerequisities:

Conditions for course completion:
Written test in the middle and the end of the semester.

Learning outcomes:
To make the acquaintance of various types of advanced porous solids and basic methods for their investigation. To gen up the students with the methods used in characterisation of specific surface area and pore size of different types of porous materials.

Brief outline of the course:
Terminology and principal terms associated with powders, porous solids and adsorption. Methodology of adsorption at the gas-solid interface, liquid-solid interface. Assessment of surface area and porosity. Inorganic materials (active carbon, metal oxides, zeolites, clay minerals, new advanced materials) and phenomenon of adsorption. Application in the industry and everyday life.

Recommended literature:
1. F. Rouquerol, J. Rouquerol, K. Sing: Adsorption by powders and porous solids, Academic press, London, UK, 1999
2. S. J. Gregg, K.S.W. Sing: Adsorption, surface area and porosity, Academic Press, London,, UK, 1982.
3. V. Zeleňák: Adsorption and porosity of solid substances, internal study text, PF UPJŠ, 2020.

Course language:

Notes:
The course is standardly realized in full-time form, in case of necessary circumstances by distance.

Course assessment
Total number of assessed students: 104

A	B	C	D	E	FX	N	P
77.88	9.62	3.85	0.0	0.0	0.0	0.0	8.65

Provides: prof. RNDr. Vladimír Zeleňák, DrSc.

Date of last modification: 21.11.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ UMV/PM/21	**Course name:** Powder functional composite materials

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

Number of ECTS credits: 4

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

Course level: III.

Prerequisities:

Conditions for course completion:
The student has to demonstrate sufficient knowledge of compacted powder composite materials with emphasis on methods of preparation of micro- and nano-composite powder material systems, structural and physical properties to successfully complete the course. He will gain basic knowledge of methods of coating, homogenization, pressing and heat treatment of powder materials, principles of structure formation, elastic, electrical and magnetic properties, as well as their applications in electrical engineering and electronics.
The credit evaluation of the course takes into account the following student workload:
1 credit: self-study of recommended and supplementary literature.
2 credits: elaboration of a presentation on a selected topic resulting from the content of the course, which is related to the topic of the dissertation.
1 credit: independent preparation for the final exam and its successful completion.

Learning outcomes:
The student will demonstrate adequate mastery of the course content as defined by the course syllabus and recommended literature after completing lectures and presentation. The results of education are:
1. Completion and acquisition of knowledge about the relationship between the parameters of compacting technology, structure and functional properties of powder materials.
2. Knowledge of the specifics of methods for characterizing the functional properties of materials.
3. Creation of terminological and knowledge prerequisites for understanding the applicability of physical phenomena in the field of progressive powder composite materials and technologies.

Brief outline of the course:
The content of the course:
1. Powdered metallic, non-metallic, polymeric and hybrid materials with specific physical properties - basic concepts. 2. Electrical, magnetic, thermal, elastic strength properties of composite materials. 3. Structural properties of functional composite materials. 4. Methods of preparation of powder materials - mechanical alloying, mechanochemical synthesis, coating of powder particles, homogenization of composite powders. 5. Methods of compacting powder composite materials - pressing, sintering, powder injection, isostatic pressing, hot pressing, sintering with the assistance of electric and magnetic fields, laser and electron beam sintering, additive

production, 3D printing. 6. Characterization of powder composites and methods for measuring functional properties. 7. Progressive compacted powder composite materials and their applications - ferromagnetic, ferrimagnetic materials, soft magnetic composites, sintered hard magnetic materials, multifunctional materials for electronics, smart composites.

Recommended literature:

1. Šalak A.: Ferrous Powder Metallurgy, Cambridge International Science Publishing, 1997
2. B. D. Cullity, C. D. Graham: Introduction to Magnetic Materials, 2nd edition, IEEE Press, Wiley, 2009, ISBN:9780470386323. https://doi.org/10.1002/9780470386323
3. Isaac Chang and Yuyuan Zhao: Advances in Powder Metallurgy - properties, processing and applications, Woodhead Publishing Limited, 2013, ISBN: 9780857098900. https://doi.org/10.1016/B978-0-12-819726-4.00151-4
4. L.J. Huang, L. Geng, H-X. Peng: Microstructurally inhomogeneous composites: Is a homogeneous reinforcement distribution optimal?, Progress in Materials Science, 71 (2015), 93–168

Course language:
english

Notes:
Teaching is carried out full-time or part-time using the MS Teams tool. The form of teaching is specified by the teacher at the beginning of the semester and it is continuously updated.

Course assessment
Total number of assessed students: 2

N	P
0.0	100.0

Provides: Ing. Radovan Bureš, CSc., doc. RNDr. Ján Füzer, PhD.

Date of last modification: 28.09.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/VYS/22	**Course name:** Presentation in Seminar

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

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Presentation at the seminar

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 39

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ZRIG/22	**Course name:** Principal investigator of an internal grant (VVGS)

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

Number of ECTS credits: 10

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

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

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 20

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ NSM/12	**Course name:** Processing, properties and applications of nanomaterials

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

Number of ECTS credits: 5

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

Course level: III.

Prerequisities:

Conditions for course completion:
To successfully complete the course, the student must demonstrate sufficient understanding of the basic concept in field of nanomaterials and their applications. For obtaining credits student must pass midterm written exam about basic concepts in field of nanomaterials. More advanced topics will be part of final oral exam. The credit evaluation of the course takes into account the following student workload: direct teaching 2 credits, self-study 1 credit, study for interim test and final test 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:
The aim of the course is to acquaint students with the preparation and properties of nanomaterials. Based on the discussed specific applications, the student will understand their unique properties and behavior.

Brief outline of the course:
Thematic areas:
1. Preparation of nanomaterials using lithographic methods.
Shaping of nanostructures. Optical lithography, electron beam lithography,
wet chemical etching, dry etching, focusing electron beam shaping, lithography using scanning probe microscopy.
2. Preparation and properties of thin films and multilayers.
Thin film preparation technologies. Steaming, sputtering, so-called atomic layer deposition,
epitaxial growth technology, nucleation and growth, planar systems, lateral structured systems, anisotropy in thin films, domain wall in thin films. Magnetic multilayers, GMR effect.
3. Preparation of nanocrystalline metals, alloys and composites by electrodeposition
Synthesis of nanostructured composite materials by electrodeposition, structure of nanocrystalline metal electrodeposited layers, properties and applications
4. Data recording and storage using nanotechnologies
The current state of commercial data storage devices, the possibilities offered by nanotechnologies, data recording using the so-called millipede concept, race track memories, gmr effect devices, so called phase change memory

5. Nanoelectronics, optoelectronics and nanorobotics.
Single electron transistor concept, manufacturing and physical porinciple. Single atom transistor: concept, production and physical principle. Optoelectronic devices and advances in nanorobotics.
6. Diffusion in NKM: Modeling of interface diffusion, diffusion in grain boundaries. Diffusion in nanocrystalline metals: specific aspects, nanocrystalline pure metals, relationship between diffusion and grain growth, selected examples of diffusion (magnetically soft and hard NKM,), hydrogen diffusion in NKM
7. Magnetic nanoparticles and their applications: Physics of magnetic nanoparticles: bulk ferromagnetism, magnetic clusters, molecular magnetism, ideal monodomain particle, surface effects and interfacial effects, exchange interaction between nanoparticles. Applications of monodomain magnets: Ferrofluids, biomedical applications, magnetic nanoparticle imaging, data storage media, magnetoresistive devices.
8. Magnetic properties of selected nanosystems: amorphous Fe-MB alloys (amorphous and nanocrystalline state, induced anisotropy), FINEMET, Influence of substitutions on properties of Finemet alloys, Fe-Zr-Nb-B alloys, Fe-Nb-BP-Cu produced in the atmosphere , the effect of grain size distribution on Tc and amorphous residue.
9. Mechanical behavior of NKM: Models and simulation of mechanical properties of NKM, models of deformation, density, pores and microcracks, elastic properties, hardness, tensile strength, ductility, examples of experimental results.

Recommended literature:

1. C.C. Koch, Nanostructured Materials – processing, Properties and Applications, WA Publishing, 2007.
2.Springer Hanbook of Nanotechnology, B. Bhusnan (Ed.), Springer 2007.
3. Nanomagnetism and Spintronics, T. Shinjo (Ed.) Elsevier 2009.
4. P.Sovák, A. Zorkovská, Structure and Magnetic Properties of FINEMET based Alloys, UPJŠ, 2008, ISBN 978-80-7097-719-4.

Course language:
slovak and english

Notes:
Teaching is carried out full-time or part-time using the MS teams platform. Form of teaching are specified by the teacher at the beginning of the semester and continuously updated as needed.

Course assessment
Total number of assessed students: 32

N	P
0.0	100.0

Provides: doc. Mgr. Vladimír Komanický, Ph.D.

Date of last modification: 27.09.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ UMV/PMM/21	**Course name:** Progressive methods of evaluating the microstructure of materials

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: 2., 4.

Course level: III.

Prerequisities:

Conditions for course completion:
To successfully complete the course, a student who has not completed the FKL master's degree must, after completing the course, demonstrate sufficient knowledge of the structure and properties of solids, basics of physical metallurgy, physics of materials and basic properties of ferrous and non-ferrous materials. For the overall evaluation, the student will prepare a ppt project from the assigned topic at the beginning of the semester. Credit evaluation of the course takes into account the following student workload: direct teaching and self-study of recommended and supplementary literature - 1 credit, elaboration of a ppt project on a selected topic - 2 credits, preparation for the test - 1 credit. The minimum limit for obtaining an evaluation for graduates of fields other than FKL is 50% of each point evaluation from the test and the project. The allocation of project / test points is 60/40. FKL graduates must obtain at least 50% points for the quality of the project.

Learning outcomes:
After completing the self-study with consultations based on the project and the final evaluation, the student will demonstrate adequate mastery of the content standard of the course, which is defined by the brief content of the course and the recommended literature. Theoretical mastery of the content of the subject allows him to fully participate in the further study of specialized subjects that are related to his assignment of the dissertation. Can independently perform diffraction and spectroscopic experiments, correctly evaluate and interpret measured data. The acquired knowledge will also facilitate the performance of the scientific part of the dissertation.

Brief outline of the course:
The timetable of the course content is updated in the electronic board. The content of the course is focused on the following important topics:
1. Basics of construction of X-ray and neutron sources.
2. Diffraction and scattering phenomena on crystalline and amorphous materials
3. Basics of diffraction record processing
4. Basics of phase analysis from X-ray. or neutron data
5. Refinement of crystallographic parameters of identified phases by Rietveld analysis method
6. Introduction to X-ray absorption spectroscopy
7. Analysis and correct interpretation of XAFS measurements

8. Introduction to mathematical modeling of disordered structures by the Reverse Monte Carlo method

Recommended literature:

1. Karel SAKSL, Praktické cvičenia z röntgenovej difraktometrie : Vysokoškolský učebný text. Košice : UPJŠ, 2020. 73 s. ISBN 978-80-8152-874-3
2. Jens Als-Nielsen, Des McMorrow Elements of Modern X-Ray Physics ‚John Wiley & Sons Inc 2001
3. Vitalij K. Pecharsky, Peter Y. Zavalij Fundamentals of Powder Diffraction and Structural Characterization of Materials, Kluwer Academic Pub, 2003
4. S Marchenini, HN Chapman, SP Hau-Riege, RA London, A Szoke, H He, MR Howells, H Padmore, R Rosen, JCH Spence, U Weierstall, Coherent X-ray diffractive imaging: applications and limitations, Optics Express 11 (9) 2344.
5. IA Vartanyants, IK Robinson, JD Onken, MA Pfeifer, GJ Williams, F Pfeiffer, H Metzger, Z Zhong, G Bauer Coherent x-ray diffraction from Quantum dots, Phys. Rev. B 71, 245302
6. Boon K. Teo, EXAFS: Basic Principles and Data Analysis, Springer-Verlag Berlin Heidelberg 1986, https://doi.org/10.1007/978-3-642-50031-2

Course language:
slovak or english

Notes:
Teaching is carried out full-time or remotely using the MS Teams tool. The form of teaching is precisely taught by the teacher at the beginning of the semester, updated continuously. Lectures are also available in LMS UPJŠ.

Course assessment
Total number of assessed students: 1

N	P
0.0	100.0

Provides: doc. Ing. Karel Saksl, DrSc.

Date of last modification: 22.09.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

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

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

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

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

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

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

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

Kniha psychologie. Universum, 2014
Čáp, J., Mareš, J.: Psychologie pro učitele. Praha: Portál 2007.
Vágnerová, M.: Školní poradenská psychológie pro pedagogy. Praha: Karolínum 2005.

Course language:
slovak

Notes:

Course assessment
Total number of assessed students: 87

abs	n	neabs
98.85	0.0	1.15

Provides: PhDr. Anna Janovská, PhD.

Date of last modification: 02.12.2024

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ Q1SA/22	**Course name:** Q1 journal as co-author

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

Number of ECTS credits: 30

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

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

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 24

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ Q11A/22	**Course name:** Q1 journal as first or corresponding author

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

Number of ECTS credits: 40

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Publication accepted in a journal of category Q1 as first or corresponding author

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 12

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ Q2SA/22	**Course name:** Q2 journal as co-author

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

Number of ECTS credits: 20

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

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

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 21

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ Q21A/22	**Course name:** Q2 journal as first or corresponding author

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

Number of ECTS credits: 30

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Publication accepted in a journal of category Q2 as first or corresponding author.

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 15

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ Q3SA/22	**Course name:** Q3 journal as co-author

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

Number of ECTS credits: 15

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

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

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 6

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ Q31A/22	**Course name:** Q3 journal as first or corresponding author

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

Number of ECTS credits: 25

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Publication accepted in a journal of category Q3 as first or corresponding author

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 2

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ Q4SA/22	**Course name:** Q4 journal as co-author

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

Number of ECTS credits: 10

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

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

Learning outcomes:
By publishing in a journal of category Q4 as a co-author, the PhD student demonstrates a high degree of ability to identify, evaluate, and apply correct scientific methods or research methodology. He demonstrates the ability to reflect on a scientific problem by using the latest approaches and applying them critically. He demonstrates the competence to use existing theories and concepts in an innovative way, as well as to generate new original scientific knowledge, which he can publish according to the highest qualitative and ethical standards of the field. The PhD student demonstrates the ability to critically evaluate and respond to reviewers' suggestions, to finalize his own ideas.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 6

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ Q41A/22	**Course name:** Q4 journal as first or corresponding author
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** distance, present	
Number of ECTS credits: 20	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Publication accepted in a journal of category Q4 as first or corresponding author.	
Learning outcomes:	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 2	

abs	n
100.0	0.0

Provides:
Date of last modification: 08.11.2022
Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/RZ/22	**Course name:** Reviewed International or National Proceedings

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

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

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

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 72

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/VPZ/22	**Course name:** Scientific work after sending to the editorial office

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

Number of ECTS credits: 5

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

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

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 20

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SFKL1a/22	**Course name:** Seminar in Condensed Matter Physics

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: 2

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Successful completing the course requires the students to participate in the seminars. If serious reasons (disease, family reasons, …) prevent the student to participate in the seminar, students may absent up to twice per semester without further consequences. For more frequent absence student will prepare presentation focused on a topic which will be consulted with the supervisor of the seminar. Student must have adequate knowledge about concepts, phenomena and laws discussed in the presented talks. Preparing a presentation is compulsory, the presentation is devoted to the discussion of scientific goals of the dissertation thesis. The student is encouraged to refer to the talks presented in the seminar. The number of credits takes into account participation of the student on the seminar, study of the recommended literature and preparation of the presentation. The level of the presentation is evaluated using the scale from 0 to 100 points. The minimum limit for successful completion of the course is to obtain 50 points from the subsequent point evaluation:
Rating scale
A 100-91
B 90-81
C 80-71
D 70-61
E 60-50
Fx 49-0

Learning outcomes:
Successful completing the course deepens knowledge of the student from the area in which student works on the dissertation thesis and from other areas of Condensed Matter Physics as well. Student will learn about scientific results of various research group from Košice and from their cooperating foreign institutions. The student is stimulated to participate in scientific discussion and to present own scientific results.

Brief outline of the course:
The program of seminars from condensed matter physics is prepared every year and is devoted to the recent results achieved in the field of condensed matter physics and material research at the laboratories in Košice and abroad. Scientific workers from laboratories from Košice as well

as domestic and foreign guests give the talks. The program also involves presentation of PhD and diploma theses.

Recommended literature:
Scientific papers, which are specified according to the scope of work of a student.

Course language:
Slovak, English

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

Course assessment
Total number of assessed students: 8

abs	n
100.0	0.0

Provides: prof. Ing. Martin Orendáč, DrSc.

Date of last modification: 18.09.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SFKL1b/22	**Course name:** Seminar in Condensed Matter Physics

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: 2

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Successful completing the course requires the students to participate on the seminars. If serious reasons (disease, family reasons, …) prevent the student to participate in the seminar, students may absent up to twice per semester without further consequences. For more frequent absence student will prepare presentation focused on a topic which will be consulted with the supervisor of the seminar. Student must have adequate knowledge about concepts, phenomena and laws discussed in the presented talks. Preparing a presentation is compulsory, the presentation is devoted to the discussion of experimental techniques which will be adopted during the work on the dissertation thesis. The student is encouraged to refer to the talks presented in the seminar. The number of credits takes into account participation of the student on the seminar, study of the recommended literature and preparation of the presentation. The level of the presentation is evaluated using the scale from 0 to 100 points. The minimum limit for successful completion of the course is to obtain 50 points from the subsequent point evaluation:
Rating scale
A 100-91
B 90-81
C 80-71
D 70-61
E 60-50
Fx 49-0

Learning outcomes:
Successful completing the course deepens knowledge of the student from the area in which student works on the dissertation thesis and from other areas of Condensed Matter Physics as well. Student will learn about scientific results of various research group from Košice and from their cooperating foreign institutions. The student is stimulated to participate in scientific discussion and to present own scientific results.

Brief outline of the course:
The program of seminars from condensed matter physics is prepared every year and is devoted to the recent results achieved in the field of condensed matter physics and material research at the laboratories in Košice and abroad. Scientific workers from laboratories from Košice as well

as domestic and foreign guests give the talks. The program also involves presentation of PhD and diploma theses.

Recommended literature:
Scientific papers, which are specified according to the scope of work of a student.

Course language:
Slovak, English

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

Course assessment
Total number of assessed students: 8

abs	n
100.0	0.0

Provides: prof. Ing. Martin Orendáč, DrSc.

Date of last modification: 18.09.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SFKL2a/22	**Course name:** Seminar in Condensed Matter Physics

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: 2

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Successful completing the course requires the students to participate in the seminars. If serious reasons (disease, family reasons, …) prevent the student to participate in the seminar, students may absent up to twice per semester without further consequences. For more frequent absence student will prepare presentation focused on a topic which will be consulted with the supervisor of the seminar. Student must have adequate knowledge about concepts, phenomena and laws discussed in the presented talks. Preparing a presentation is compulsory, the presentation is devoted to three selected papers of other authors working in the same field.
The student is encouraged to refer to the talks presented in the seminar. The number of credits takes into account participation of the student on the seminar, study of the recommended literature and preparation of the presentation. The level of the presentation is evaluated using the scale from 0 to 100 points. The minimum limit for successful completion of the course is to obtain 50 points from the subsequent point evaluation:
Rating scale
A 100-91
B 90-81
C 80-71
D 70-61
E 60-50
Fx 49-0

Learning outcomes:
Successful completing the course deepens knowledge of the student from the area in which student works on the dissertation thesis and from other areas of Condensed Matter Physics as well. Student will learn about scientific results of various research group from Košice and from their cooperating foreign institutions. The student is stimulated to participate in scientific discussion and to present own scientific results.

Brief outline of the course:
The program of seminars from condensed matter physics is prepared every year and is devoted to the recent results achieved in the field of condensed matter physics and material research at the laboratories in Košice and abroad. Scientific workers from laboratories from Košice as well

as domestic and foreign guests give the talks. The program also involves presentation of PhD and diploma theses.

Recommended literature:
Scientific papers, which are specified according to the scope of work of a student.

Course language:
Slovak, English

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

Course assessment
Total number of assessed students: 12

abs	n
100.0	0.0

Provides: prof. Ing. Martin Orendáč, DrSc.

Date of last modification: 18.09.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SFKL2b/22	**Course name:** Seminar in Condensed Matter Physics

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: 2

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Successful completing the course requires the students to participate in the seminars. If serious reasons (disease, family reasons, …) prevent the student to participate in the seminar, students may absent up to twice per semester without further consequences. For more frequent absence student will prepare presentation focused on a topic which will be consulted with the supervisor of the seminar. Student must have adequate knowledge about concepts, phenomena and laws discussed in the presented talks. Preparing a presentation is compulsory, the presentation is devoted to the results obtained during work on dissertation thesis which have been, or will be published. Alternatively, the presentation may address potential practical applications of the studied materials. The student is encouraged to refer to the talks presented in the seminar. The number of credits takes into account participation of the student on the seminar, study of the recommended literature and preparation of the presentation. The level of the presentation is evaluated using the scale from 0 to 100 points. The minimum limit for successful completion of the course is to obtain 50 points from the subsequent point evaluation:
Rating scale
A 100-91
B 90-81
C 80-71
D 70-61
E 60-50
Fx 49-0

Learning outcomes:
Successful completing the course deepens knowledge of the student from the area in which student works on the dissertation thesis and from other areas of Condensed Matter Physics as well. Student will learn about scientific results of various research group from Košice and from their cooperating foreign institutions. The student is stimulated to participate in scientific discussion and to present own scientific results.

Brief outline of the course:
The program of seminars from condensed matter physics is prepared every year and is devoted to the recent results achieved in the field of condensed matter physics and material research at

the laboratories in Košice and abroad. Scientific workers from laboratories from Košice as well as domestic and foreign guests give the talks. The program also involves presentation of PhD and diploma theses.

Recommended literature:
Scientific papers, which are specified according to the scope of work of a student.

Course language:
Slovak, English

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

Course assessment
Total number of assessed students: 13

abs	n
100.0	0.0

Provides: prof. Ing. Martin Orendáč, DrSc.

Date of last modification: 18.09.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ SFKL3a/22	**Course name:** Seminar in Condensed Matter Physics

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: 2

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Successful completing the course requires the students to participate in the seminars. If serious reasons (disease, family reasons, …) prevent the student to participate in the seminar, students may absent up to twice per semester without further consequences. For more frequent absence student will prepare presentation focused on a topic which will be consulted with the supervisor of the seminar. Student must have adequate knowledge about concepts, phenomena and laws discussed in the presented talks. Preparing a presentation is compulsory, the presentation is devoted to the results obtained during work on dissertation thesis which have been, or will be published. The student is encouraged to refer to the talks presented in the seminar. The number of credits takes into account participation of the student on the seminar, study of the recommended literature and preparation of the presentation. The level of the presentation is evaluated using the scale from 0 to 100 points. The minimum limit for successful completion of the course is to obtain 50 points from the subsequent point evaluation:
Rating scale
A 100-91
B 90-81
C 80-71
D 70-61
E 60-50
Fx 49-0

Learning outcomes:
Successful completing the course deepens knowledge of the student from the area in which student works on the dissertation thesis and from other areas of Condensed Matter Physics as well. Student will learn about scientific results of various research group from Košice and from their cooperating foreign institutions. The student is stimulated to participate in scientific discussion and to present own scientific results.

Brief outline of the course:
The program of seminars from condensed matter physics is prepared every year and is devoted to the recent results achieved in the field of condensed matter physics and material research at the laboratories in Košice and abroad. Scientific workers from laboratories from Košice as well

as domestic and foreign guests give the talks. The program also involves presentation of PhD and diploma theses.

Recommended literature:
Scientific papers, which are specified according to the scope of work of a student.

Course language:
Slovak, English

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

Course assessment
Total number of assessed students: 14

abs	n
100.0	0.0

Provides: prof. Ing. Martin Orendáč, DrSc.

Date of last modification: 18.09.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SFKL3b/22	**Course name:** Seminar in Condensed Matter Physics

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: 2

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Successful completing the course requires the students to participate in the seminars. If serious reasons (disease, family reasons, …) prevent the student to participate in the seminar, students may absent up to twice per semester without further consequences. For more frequent absence student will prepare presentation focused on a topic which will be consulted with the supervisor of the seminar. Student must have adequate knowledge about concepts, phenomena and laws discussed in the presented talks. Preparing a presentation is compulsory, the presentation is devoted to the results obtained during work on dissertation thesis which have been, or will be published. The student is encouraged to refer to the talks presented in the seminar. The number of credits takes into account participation of the student on the seminar, study of the recommended literature and preparation of the presentation. The level of the presentation is evaluated using the scale from 0 to 100 points. The minimum limit for successful completion of the course is to obtain 50 points from the subsequent point evaluation:
Rating scale
A 100-91
B 90-81
C 80-71
D 70-61
E 60-50
Fx 49-0

Learning outcomes:
Successful completing the course deepens knowledge of the student from the area in which student works on the dissertation thesis and from other areas of Condensed Matter Physics as well. Student will learn about scientific results of various research group from Košice and from their cooperating foreign institutions. The student is stimulated to participate in scientific discussion and to present own scientific results.

Brief outline of the course:
The program of seminars from condensed matter physics is prepared every year and is devoted to the recent results achieved in the field of condensed matter physics and material research at the laboratories in Košice and abroad. Scientific workers from laboratories from Košice as well

as domestic and foreign guests give the talks. The program also involves presentation of PhD and diploma theses.

Recommended literature:
Scientific papers, which are specified according to the scope of work of a student.

Course language:
Slovak, English

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

Course assessment
Total number of assessed students: 15

abs	n
100.0	0.0

Provides: prof. Ing. Martin Orendáč, DrSc.

Date of last modification: 18.09.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SFKL4a/22	**Course name:** Seminar in Condensed Matter Physics

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: 2

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Successful completing the course requires the students to participate in the seminars. If serious reasons (disease, family reasons, …) prevent the student to participate in the seminar, students may absent up to twice per semester without further consequences. For more frequent absence student will prepare presentation focused on a topic which will be consulted with the supervisor of the seminar. Student must have adequate knowledge about concepts, phenomena and laws discussed in the presented talks. Preparing a presentation is compulsory, the presentation is devoted to the results obtained during work on dissertation thesis which have been, or will be published. The student is encouraged to refer to the talks presented in the seminar. The number of credits takes into account participation of the student on the seminar, study of the recommended literature and preparation of the presentation. The level of the presentation is evaluated using the scale from 0 to 100 points. The minimum limit for successful completion of the course is to obtain 50 points from the subsequent point evaluation:
Rating scale
A 100-91
B 90-81
C 80-71
D 70-61
E 60-50
Fx 49-0

Learning outcomes:
Successful completing the course deepens knowledge of the student from the area in which student works on the dissertation thesis and from other areas of Condensed Matter Physics as well. Student will learn about scientific results of various research group from Košice and from their cooperating foreign institutions. The student is stimulated to participate in scientific discussion and to present own scientific results.

Brief outline of the course:
The program of seminars from condensed matter physics is prepared every year and is devoted to the recent results achieved in the field of condensed matter physics and material research at the laboratories in Košice and abroad. Scientific workers from laboratories from Košice as well

as domestic and foreign guests give the talks. The program also involves presentation of PhD and diploma theses.

Recommended literature:
Scientific papers, which are specified according to the scope of work of a student.

Course language:
Slovak, English

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

Course assessment
Total number of assessed students: 15

abs	n
100.0	0.0

Provides: prof. Ing. Martin Orendáč, DrSc.

Date of last modification: 18.09.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SFKL4b/22	**Course name:** Seminar in Condensed Matter Physics

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: 2

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Successful completing the course requires the students to participate in the seminars. If serious reasons (disease, family reasons, …) prevent the student to participate in the seminar, students may absent up to twice per semester without further consequences. For more frequent absence student will prepare presentation focused on a topic which will be consulted with the supervisor of the seminar. Student must have adequate knowledge about concepts, phenomena and laws discussed in the presented talks. Preparing a presentation is compulsory, the presentation is devoted to disertation thesis. Student, using the presentation, must give a talk at the seminar, duration of the talk is 45 min. The number of credits takes into account participation of the student on the seminar, study of the recommended literature, preparation of the presentation and the talk. The level of both, the presentation and talk, is evaluated using scale from 0 to 100 points. The minimum limit for successful completion of the course is to obtain 50 points from the subsequent point evaluation:
Rating scale
A 100-91
B 90-81
C 80-71
D 70-61
E 60-50
Fx 49-0

Learning outcomes:
Successful completing the course deepens knowledge of the student from the area in which student works on the dissertation thesis and from other areas of Condensed Matter Physics as well. Student will learn about scientific results of various research group from Košice and from their cooperating foreign institutions. The student is stimulated to participate in scientific discussion an to present own scientific results.

Brief outline of the course:
The program of seminars from condensed matter physics is prepared every year and is devoted to the recent results achieved in the field of condensed matter physics and material research at the laboratories in Košice and abroad. Scientific workers from laboratories from Košice as well

as domestic and foreign guests give the talks. The program also involves presentation of PhD and diploma theses.

Recommended literature:
Scientific papers, which are specified according to the scope of work of a student.

Course language:
Slovak, English

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

Course assessment
Total number of assessed students: 15

abs	n
100.0	0.0

Provides: prof. Ing. Martin Orendáč, DrSc.

Date of last modification: 18.09.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ SPM1/14	**Course name:** Special Practicum 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: 5

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

Course level: III.

Prerequisities:

Conditions for course completion:
To successfully complete the course, the student must complete all experimental tasks determined by the syllabus and evaluate the experimental results in the form of a protocol.
The condition for the implementation of the practical task is sufficient theoretical training at home.
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
2 credits: elaboration and submission of protocols from measurements, which are evaluated
1 credit: final presentation of the defense of the measurement procedure and analysis of experimental data from the selected task.

Learning outcomes:
The result of education is:
1) Acquisition of basic abilities and skills in experimental research of selected phenomena in areas of magnetic and structural properties of materials.
2) Analysis and interpretation of results and experience in preparing the protocols on measurement and measurement results.

Brief outline of the course:
Measurement of electrical resistivity (S. Dobák).
Measurement of initial magnetization curves and hysteresis loops in quasi-static and dynamic regime (S. Dobák).
Measurement of complex permeability spectra (S. Dobák).
Observation of the domain structure of ferromagnets by colloidal technique using optical microscope. (A. Zeleňáková)
Observation of the domain structure of ferromagnets by the MFM method. (A. Zeleňáková)
Measurement of temperature and field dependence of magnetization of magnetic substances using a device
MPMS based on SQUID. (A. Zeleňáková)
Magnetoimpedance measurement. (L. Galdun)
Measurement of domain wall dynamics (L. Galdun)
Magneto-optical measurements using the Kerr effect. (L. Galdun)

Study of atomic structure using powder XRD (J. Bednarčík)
Study of atomic structure using single crystal XRD diffraction (J. Bednarčík)
Study of structural substances using SAXS (J. Bednarčík)

Recommended literature:

Tumanski S, Handbook of magnetic measurements, CRC press, 2011.
Fiorillo F, Characterization and Measurement of Magnetic Materials, Elsevier, 2004.
Hajko V, Potocký L., Zentko A.: Magnetizačné procesy, Alfa, 1982, Bratislava.
Dufek M., Hrabák J., Trnaka Z.: Magnetická měření, SNTL, 1964, Praha

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. The form of teaching will be specified by the teacher at the beginning of the semester, it is continuously updated.

Course assessment
Total number of assessed students: 45

abs	n
100.0	0.0

Provides: doc. RNDr. Adriana Zeleňáková, PhD., RNDr. Ladislav Galdun, PhD., RNDr. Samuel Dobák, PhD., RNDr. Jozef Bednarčík, PhD., univerzitný docent

Date of last modification: 01.10.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ SPM2/14	**Course name:** Special Practicum 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: 5

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

Course level: III.

Prerequisities:

Conditions for course completion:
Successful completing the course requires the students to demonstrate sufficient knowledge and skills in experimental study of selected properties of solids at predominantly low temperatures. The number of credits takes into account participation of the student on the laboratory exercises (2 credits), study of the recommended literature (2 credit), and preparation of the reports (1 credit). Number of credits for study of the recommended literature is related to the fact that each report, apart from detailed description of experimental tasks and experimental data acquisition, should contain solution of physical problems formulated by the teacher which are relevant to the scope of the exercise. Activity and skills in participating experiments and the level of the report which should contain theoretical background, discussion how formulated goals were met and/or acquisition of the experimental data are evaluated. Submitting all reports represent necessary condition for passing the course. Activity of the student during conducting experiments is evaluated in range 0 – 25 points. Quality of the report is evaluated using the scale 0 – 100 points. The minimum limit for successful completion of the course is to obtain 50 points in total from the subsequent point evaluation:
Rating scale
A 100-91
B 90-81
C 80-71
D 70-61
E 60-50
Fx 49-0

Learning outcomes:
Obtaining fundamental theoretical, experimental skills and ability to analyze the obtained experimental data in selected areas of physical research in condensed matter, primarily at low temperatures.

Brief outline of the course:
Exercises n. 1. – 6. are given by prof. Ing. M. Orendáč, DrSc., exercises n. 7. – 12. are given by doc. RNDr. E. Čižmár, PhD.

1.Calibration of resistance thermometers. Choice of a function for the analysis of the calibration curve, determination of the degree of the fitting polynom. Analysis of the temperature dependence of the relative deviation.
2. Determination of the magnitude of the spin from calorimetric data. Determination of the molar specific heat. Standard extrapolations for the calulation of the magnetic entropy at low and high temperatures. Calculation of contributions to magnetic entropy.
3. Magnetocaloric effect. Calculation of the temperature dependence of the isothermal change of magnetic entropy from calorimetric data. Comparisson of the data for quantum spin chain and S=1/2 paramagnet.
4. Study of spin dynamics from the data of alternating susceptibility. Cole – Cole diagram and its construction. Width of the distribution of relaxation times. Temperature dependence of relaxation processes in a selected model system.
5. Study of critical behavior from calorimetric data. Analysis of the specific heat data in a critical region for different magnetic fields. Critical indexes, their dependence on external magnetic field. Comparisson of the values of critical indexes with predictions for selected models.
6. Experimental study of spin-glass state. Analysis of static magnetic susceptibility data obtained in "zero-field cooled" and "field-cooled" regimes. Study of the influence of external magnetic field. Analysis of alternating susceptibility data obtained at various temperatures. Study of the effect of the excitation frequency. Construction of Cole-Cole diagrams.
7. Vacuum technique. Methods of leak detection in vacuum systems.
8. Preparation of the samples. Specific heat measurements in cryogenic devices. Analysis and intrepretation of the experimental results.
9. Susceptibility and magnetization of magnetic systems. Preparation of the sample, setting sequence of measurement for SQUID magnetometer.
10. Analysis of the experimental data of magnetization and susceptibility (Curie – Weiss law, Brillouin function, determination of the nature of exchange coupling)
11. Electron paramagnetic resonance in magnetic systems. Preparation of the sample, collection of the data. Analysis of the obtained data (Determination of the anisotropy of g-factor, analysis of the resonance linewidth)
12. Electrical resistivity in normal metals and superconductors. Preparation of the sample, setting sequence of measurement for PPMS device. Analysis of the obtained data (determination of RRR, residual resistivity, critical temperature of a superconductor).

Recommended literature:

J. H. Moore and N. D. Spencer: Encyclopedia o Chemical Physics and Physical Chemistry Vol. I., II. and III., IoP Publishing Ltd. 2001, ISBN 0750303131.
Selected scientific publications.
F. Pobell, Methods and Matter at Low Temperatures, Springer Verlag, Berlin Heidelberg, 1992.
J. A. Mydosh, Spin glasses: An Experimental Introduction, Taylor&Francis, 1993.
Selected scientific papers with appropriate scope.

Course language:

slovak, english

Notes:

Presence form represents a standard form for the course, if a need arises, the course can be partially performed using MS Teams.

Course assessment Total number of assessed students: 42	
abs	n
100.0	0.0
Provides: doc. RNDr. Erik Čižmár, PhD., prof. Ing. Martin Orendáč, DrSc.	
Date of last modification: 22.09.2021	
Approved: prof. RNDr. Pavol Sovák, CSc.	

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

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

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

Number of ECTS credits: 2

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

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

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

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

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

Course language:

Notes:

Course assessment
Total number of assessed students: 202

abs	n
100.0	0.0

Provides: doc. RNDr. Andrea Straková Fedorková, PhD.

Date of last modification: 08.11.2022
Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ UMV/KKM/21	**Course name:** Structural ceramic materials: technology-microstructure-properties

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: 2., 4.

Course level: III.

Prerequisities:

Conditions for course completion:
To successfully complete the course, students who have not completed the Condensed Matter Physics (CMP) master's degree must, after completing the course, demonstrate sufficient knowledge of the technological processes of production of structural ceramics and composites with brittle matrix and from basic methods of evaluation of their microstructure and fracture-mechanical properties.
Graduates of the CMP master's study, under the guidance of the supervisor, will focus on the properties of the ceramic and composite materials that are the subject of their dissertation and for the overall evaluation will prepare a written project on the assigned topic at the beginning of the semester. Credit evaluation of the course takes into account the following student workload: direct teaching/consultations and self-study of recommended supplementary literature - 1 credit, elaboration of a written project on a selected topic - 2 credits, preparation for the test - 1 credit. The minimum limit for obtaining an evaluation for graduates of fields other than CMP is 50 % of each point evaluation from the test and the project. The allocation of project / test points is 60/40. FKL graduates must obtain at least 50 % points for the quality of the project.

Learning outcomes:
After completing consultations and self-study, based on the project and the final evaluation, the students will demonstrate adequate knowledge of the course content standards, which are defined by the brief content of the course and the recommended literature. Theoretical understanding of the subject content allows them to fully participate in the further study of specialized subjects that are related to the assignment of the dissertation. The doctoral student will get acquainted with the technological processes of production of structural ceramics and composites with a brittle matrix; basic methods of evaluation of microstructure and fracture-mechanical properties. The acquired knowledge will also facilitate the performance of the scientific part of the dissertation.

Brief outline of the course:
The time schedule of the course content is updated in the electronic bulletin board in AiS2 sw. The subject content is focused on the following main topics:
1. Technological procedures for the production of structural ceramic materials, composites, nano-composites, layered composites, coatings, etc.
2. Microstructural analysis and analysis of fracture characteristics.

3. Evaluation of mechanical properties, nano-micro-macro hardness, strength, fracture toughness, creep, etc.
4. Determining the relationship between microstructure and mechanical properties.
5. 5. Modeling of microstructure and fracture / degradation processes at room temperature and at high temperatures.

Recommended literature:

1. Pánek, Z., Figusch, V., Haviar, M., Ličko, T., Šajgalík, P.,Dusza, J.: Konštrukčná keramika, R & D Print Bratislava, 1992.
2. Hidvéghi, J., Dusza, J.: Nekovové konštrukčné materiály, TU Košice, 1998.
3. Munz, T., Fett, D.: Mechanisches Verhalten keramischer Werkstoffe. Springer Verlag –Berlin, Heidelberg, New Zork, 1989
4. Dusza, J., Steen, M.:Fractography and fracture mechanics properties assessment of advanced structural ceramics, Internat. Mater. Reviews 1995, vol. 44, no. 5.

Course language:
Slovak or English

Notes:
Lectures can be done at presence form or online form using MS Teams. Education form is updated at the begining of the subject. All ppt presentations are accessible in LMS UPJŠ.

Course assessment
Total number of assessed students: 1

N	P
0.0	100.0

Provides: prof. RNDr. Ján Dusza, DrSc.

Date of last modification: 23.09.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ XRAY/20	**Course name:** Structure characterization by X-ray based techniques

Course type, scope and the method:
Course type: Lecture / Practice
Recommended course-load (hours):
Per week: 2 / 0 **Per study period:** 28 / 0
Course method: present

Number of ECTS credits: 3

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

Course level: II., III.

Prerequisities:

Conditions for course completion:
To successfully complete the course, student must attend all lectures. In justified cases, two absences are allowed. Furthermore, for successful completion of the course, a written elaboration of the assignment is assumed. The credit evaluation of the course takes into account the following student workload: direct teaching and self-study of recommended literature - 2 credits, elaboration of a written assignment - 1 credit.

Learning outcomes:
To understand basic concepts of the X-ray crystallography and X-ray powder diffraction. Be able to perform phase analysis, refine the value of the lattice constant and estimate the average grain size from raw diffraction data. To understand basic concepts of the synchrotron radiation and its properties. Get familiarized with selected scattering, spectroscopy and imaging techniques utilizing synchrotron radiation.

Brief outline of the course:
X-rays are a unique tool to characterize the atomic and electronic structure of many materials, including periodic/ordered and non-periodic/disordered systems. X-ray diffraction and scattering methods provide structural information of mainly periodic systems down to atomic resolution. The course is divided in two sections. The first part covers basic concepts of the X-ray crystallography and X-ray powder diffraction, which represents one of the most essential tools in the structural characterization of materials. The first part is complemented with a hands-on laboratory section which aims to prepare reader to be able to independently deploy the technique for use in own research. The second part of the course covers basics concepts of the synchrotron radiation. Perspective reader will learn about unique properties of synchrotron radiation and its use in various scattering, spectroscopy and imaging techniques. The layout of typical synchrotron beamline with all essential components (monochromator, mirrors, focusing lenses, slit systems, sample stage and detectors) will be presented. Experimental techniques such as Small Angle X-ray Scattering (SAXS), Pair Distribution Function (PDF), X-ray Absorption Spectroscopy and X-ray Computed Tomography will be introduced in more details. At the end there will be a lesson covering recent development in the emerging field of X-ray Free Electron Lasers (XFELs)

Recommended literature:

[1] V. K. Pecharsky and P. Y. Zavalij, „Fundamentals of Powder Diffraction and Structural Characterization of Materials“, Springer, New York, 2005.
[2] D. Attwood and A. Sakdinawat, „X-Rays and Extreme Ultraviolet Radiation: Principles and Applications“, 2nd Edition, Cambridge University Press, 2016.
[3] M. Watanabe, S. Sato, I. Munro and G.S. Lodha, „A Guide to Synchrotron Radiation Science“, Narosa Publishing House. New Delhi, 2016
[4] U. Bergmann, V. K. Yachandra and J. Yano, „ X-Ray Free Electron Lasers: Applications in Materials, Chemistry and Biology“, The Royal Society of Chemistry, London, 2017

Course language:
slovak, english

Notes:
The course will be taught in person or using online communication tools.

Course assessment
Total number of assessed students: 21

abs	n
100.0	0.0

Provides: RNDr. Jozef Bednarčík, PhD., univerzitný docent

Date of last modification: 28.09.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/VPSV/22	**Course name:** Supervision of Student's Scientific Activity

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

Number of ECTS credits: 8

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Supervision of Student's Scientific Activity

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 5

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/VZP/22	**Course name:** Supervisor/consultant of fianl thesis

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

Number of ECTS credits: 8

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Supervisor of the final thesis.

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 2

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ FPO/14	**Course name:** Surface science

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: 1., 3.

Course level: II., III.

Prerequisities:

Conditions for course completion:
To successfully complete the course, the student must demonstrate sufficient understanding of the basic principles in the field of surface physics and superficial science. The credit evaluation of the course takes into account the following student workload: direct teaching 2 credits, final exam 1 credit. The condition for obtaining credits is passing an oral exam on questions within selected topic. 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:
The goal of this course is to introduce student to theory and physical properties of surfaces, processes and phenomena on surfaces and methods used for their study. In the introduction i will make general overview of terminology in physics of surfaces, electronic structure of solids with application to surfaces. I will make detailed overview of experimental methods used for surface characterization. Student will learn about theory of adsorption and diffusion on surfaces, with thermodynamics and kinetics of processes on surfaces and growth of layers. I will show examples of physical and chemical processes on surfaces in real applications. Student will gain basic knowledge about theory of interfaces and about processes stimulated by laser and electrons and about manipulation on surfaces on nanoscale.

Brief outline of the course:
1. Introduction.
2. Electronic structure. Band theory of solids: metals, semiconductors and isolators.
3. Experimental methods to study surfaces.
4. Diffusion on surfaces.
5. Adsorption on surfaces.
6. Thermodynamics and kinetics of adsorption and desorption.
7. Interfaces.
8. Catalytic processes on surfaces.
9. Growth on surfaces and epitaxy.
10. Processes on surfaces simulated by photons and electrons.
11. Electrified interfaces.

12. Manipulation on surfaces.

Recommended literature:

1. K. W. Kolasinski, Surface Science Foundations of Catalysis and Nanoscience, John Wiley and Sons, Ltd. 2008.
2. Ch. Kittel, Introduction to Solid State Physics, 7th edition, John Wiley and Sons, 1995.
3. A. Zangwill Physics at Surfaces, Cambridge university press, 1988

Course language:
slovak, english

Notes:
Teaching is carried out full-time or part-time using the MS teams platform. Form of teaching are specified by the teacher at the beginning of the semester and continuously updated as needed.

Course assessment
Total number of assessed students: 36

A	B	C	D	E	FX	N	P
44.44	27.78	0.0	0.0	0.0	0.0	0.0	27.78

Provides: doc. Mgr. Vladimír Komanický, Ph.D.

Date of last modification: 28.09.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ PPC1/22	**Course name:** Teaching activities 1h/s

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

Number of ECTS credits: 2

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Direct teaching activity 1 semester hour

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 6

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ PPC2/22	**Course name:** Teaching activities 2h/s

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

Number of ECTS credits: 4

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Direct teaching activity 2 semester hours

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 6

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ PPC3/22	**Course name:** Teaching activities 3h/s

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

Number of ECTS credits: 6

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Direct teaching activity 3 semester hours

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 10

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/ PPC4/22	**Course name:** Teaching activities 4h/s

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

Number of ECTS credits: 8

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Direct teaching activity 4 semester hours

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 7

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/UMV/FAZY/21	**Course name:** Theory of phase transformations in solids

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

Number of ECTS credits: 4

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
reaching adequate knowledge and confirming of it in profesional discourse

Learning outcomes:
enlarging knowledge about thermal activated phase transitions of diffusion nature in mainly alloy systems, under isothermal and athermal conditions

Brief outline of the course:

Recommended literature:
E. J. Mittenaijer: Fundamentals of Materials Science, Springer Verlag, Berlin Heidelberg 2010. ISBN 978-3-642-10499-2
P. Lejček: Grain boundary Segregation in Metals, Springer Verlag, Berlin Heidelberg 2010. ISBN 978-3-642-12504-1
D. L. Sidebottom: Fundamentals of condensed Matter and Crystalline Physics, Cambridge University Press, New York 2012. ISBN 978-1-107-01710-8
J. Janovec: Nature of Alloy Steel Intergranullar Embittlement, VEDA, Bratislava1999. IBSN 80-224-0611-2

Course language:
Slovak, English

Notes:
free of remarks

Course assessment
Total number of assessed students: 0

N	P
0.0	0.0

Provides: RNDr. Peter Ševc, CSc., prof. Ing. Jozef Janovec, DrSc.

Date of last modification: 22.09.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚCHV/ TA1/03	**Course name:** Thermal Analysis

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

Number of ECTS credits: 5

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

Course level: II., III.

Prerequisities:

Conditions for course completion:
Successful completion of a written test. In accordance with the UPJŠ Study Regulations, successful completion is conditioned by obtaining at least 51% of the maximum possible points.
Active and mandatory participation in seminars, elaboration of seminar papers. Each student will prepare one seminar paper on a given topic.

Learning outcomes:
The student will gain information about the methods of thermal analysis used to study and characterize the physical and chemical properties of inorganic and organic compounds as well as solid materials during heating, the equipment used to study thermal properties and the reaction kinetics of decomposition processes.
Mastering the basic principles and methods of thermal analysis and its use to characterize changes in the physical and chemical properties of the substance during heating (inorganic compounds and materials, organic substances and pharmaceuticals).

Brief outline of the course:
1. Introduction, history, definition and development of thermal analysis methods. Terminology of thermal analysis.
2. Classification of thermal analysis methods. Overview of individual thermoanalytical techniques and measured parameters. Description of thermoanalytical curves. Isothermal and non-isothermal methods of thermal analysis.
3.) Equipment and instruments used in thermal analysis.
4.) Thermocouples, their construction and division. Temperature measurement method, thermocouples, resistance thermometers, thermistors.
5.) Classification of processes monitored by thermal analysis (solid-solid reaction, solid-liquid, solid-gas, melt reactions).
6.) Thermogravimetry methods (TG / DTG). Principle, methods, thermal scales, types of scales, temperature measurement.
7.) DSC and DTA method (principle, method of connecting thermocouples, sample carriers, registration devices).
8.) Other methods of thermal analysis - emanation thermal analysis, thermodilatometry, thermomechanical analysis, thermomagnetometry.

9.) Analysis of released gases and coupled techniques in thermal analysis (IČ, MS)
10.) Basics of kinetics.
11.) Methods for determining the kinetics of processes from thermoanalytical measurements (ASTM, OFW, Friedman analysis, model-free methods)
12. Presentation and publication of results of thermoanalytical measurements. Application of TA methods to inorganic, organic materials and minerals.

Recommended literature:

1. Zeleňák, V.: Termická analýza, Interný učebný text, PF UPJŠ, 2020.
2. Györyová K., Balek V.: Termická analýza, PF UPJŠ, Edičné stredisko, Košice, 1992.
3. Brown E.M., Gallagher P.K.: Handbook od Thermal Analysis and Calorimetry , Elsevier Amsterdam 2008.
4. Bohne G.H., Hemminger W.F., Flammerschein H.J.. Differential Scanning Calorimetry, Springer Verlag Berlin 2003
5. Blažek A.: Termická analýza, Praha, 1972, SNTL
6. Wendlandt W. W.: Thermal Methods of Analysis, 2. vydanie, New York, 1985.
7. Šesták J.: Měření termofyzikálních vlastností pevných látek, Academia Praha, 1982.

Course language:
Slovak, English

Notes:
The course is standardly realized in full-time form, in case of necessary circumstances by distance.

Course assessment
Total number of assessed students: 89

A	B	C	D	E	FX	N	P
58.43	15.73	8.99	1.12	1.12	0.0	0.0	14.61

Provides: prof. RNDr. Vladimír Zeleňák, DrSc.

Date of last modification: 21.11.2021

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/KZP/22	**Course name:** Thesis consultant

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

Number of ECTS credits: 4

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Final thesis consultant.

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

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 6

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice

Faculty: Faculty of Science

Course ID: ÚFV/POVK/22	**Course name:** Work in Organizing Committee of Conference

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

Number of ECTS credits: 3

Recommended semester/trimester of the course:

Course level: III.

Prerequisities:

Conditions for course completion:
Work in the organizing committee of the conference

Learning outcomes:
By working in the organizing committee of the conference, the PhD student demonstrates the abilities and competences to organize a scientific or professional event independently or in a team, to manage the implementation in terms of time and content, to communicate effectively verbally and in writing using various technical means as needed, including in a foreign language at a professional level with various types of people, if necessary, correctly recommend solutions or make independent decisions.

Brief outline of the course:

Recommended literature:

Course language:

Notes:

Course assessment
Total number of assessed students: 18

abs	n
100.0	0.0

Provides:

Date of last modification: 08.11.2022

Approved: prof. RNDr. Pavol Sovák, CSc.

COURSE INFORMATION LETTER

University: P. J. Šafárik University in Košice	
Faculty: Faculty of Science	
Course ID: ÚFV/ PDS/22	**Course name:** Writing Dissertation Work
Course type, scope and the method: **Course type:** **Recommended course-load (hours):** **Per week: Per study period:** **Course method:** distance, present	
Number of ECTS credits: 20	
Recommended semester/trimester of the course:	
Course level: III.	
Prerequisities:	
Conditions for course completion: Obtaining the required number of credits in the prescribed composition according to the UPJŠ study regulations, preparation and defense of the thesis, successfully completed dissertation examination	
Learning outcomes: The PhD student demonstrated the prerequisites for successful continuation of the study by fulfilling the conditions prescribed by the study regulations for the study and scientific part of the doctoral study related to the topic of the dissertation.	
Brief outline of the course:	
Recommended literature:	
Course language:	
Notes:	
Course assessment Total number of assessed students: 26	

N	P
3.85	96.15

Provides:
Date of last modification: 08.11.2022
Approved: prof. RNDr. Pavol Sovák, CSc.