Course descriptions

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COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/3-MXX-101/15	Course of English for PhD Studies (1)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning, distance learning

Number of credits: 5

Recommended semester:

Educational level: III.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 166

A	ABS	B	C	D	E	FX	NEABS
50,6	43,98	0,6	0,0	0,0	2,41	0,0	2,41

Lecturers: PhDr. Alena Zemanová

Last change: 20.06.2022

Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJP/3-MXX-102/15	Course of English for PhD Studies (1)

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning, distance learning

Number of credits: 5

Recommended semester:

Educational level: III.

Prerequisites: FMFI.KJP/3-MXX-101/15 - Course of English for PhD Studies (1)

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 161

A	ABS	B	C	D	E	FX	NEABS
54,66	38,51	0,0	0,0	0,0	0,0	0,0	6,83

Lecturers: PhDr. Alena Zemanová

Last change: 20.06.2022

Approved by:

STATE EXAM DESCRIPTION

Academic year: 2021/2022	
University: Comenius University Bratislava	
Faculty: Faculty of Mathematics, Physics and Informatics	
Course ID: FMFI.KTF/3-FVM-990/15	**Course title:** Dissertation Thesis Defense
Number of credits: 30	
Recommended semester: 7., 8..	
Educational level: III.	
State exam syllabus:	
Last change: 02.06.2015	
Approved by:	

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/3-FVM-211/15	Exactly Solvable Models in Quantum Mechanics and Statistical Physics

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning, distance learning

Number of credits: 10

Recommended semester:

Educational level: III.

Prerequisites:

Course requirements:
Continuous assessment: continuous test
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
After completing the course, students will be able to explain under what circumstances the system of interacting particles (or spins) is exactly solvable.
Solution of several model systems.

Class syllabus:
Bethe ansatz method. Analysis of Bethe equations and determination of ground state energy (free energy) as well as the first excited levels depending on the model parameters. Formalization of Bethe ansatz via Yang-Baxter equations, "inverse method of quantum scattering matrix". Model systems: two-dimensional Ising model, one-dimensional quantum Heisenberg model and Hubbard model.

Recommended literature:
R. J. Baxter, Exactly Solved Models in Statistical Mechanics, Acad. Press, 1982 (rus. Mir, 1985).
L. D. Faddeev, How Algebraic Bethe Ansatz works for integrable model, in "Les Houches lectures" (Elsevier, 1997); arXiv:hep-th/9605187.
T. Deguchi, Introduction to solvable lattice models in statistical and mathematical physics, in "Classical and Quantum Integrable Systems: Theory and Application" (IOP Publishing, 2003); cond-mat/0304309.

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 3

A	ABS	B	C	D	E	FX	NEABS
33,33	33,33	33,33	0,0	0,0	0,0	0,0	0,0

Lecturers: RNDr. Ladislav Šamaj, DrSc.

Last change: 15.03.2022

Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/3-FVM-105/15	Individual Study of Research Resources (1)

Educational activities:
Type of activities: independent work
Number of hours:
per week: 4 **per level/semester:** 52
Form of the course: on-site learning, distance learning

Number of credits: 10

Recommended semester: 1.

Educational level: III.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 29

A	ABS	B	C	D	E	FX	NEABS
82,76	17,24	0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Tomáš Blažek, PhD.

Last change: 02.06.2015

Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/3-FVM-106/15	Individual Study of Research Resources (2)

Educational activities:
Type of activities: independent work
Number of hours:
per week: 4 **per level/semester:** 52
Form of the course: on-site learning, distance learning

Number of credits: 10

Recommended semester: 2.

Educational level: III.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 28

A	ABS	B	C	D	E	FX	NEABS
78,57	17,86	3,57	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Tomáš Blažek, PhD.

Last change: 02.06.2015

Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/3-FVM-107/15	Individual Study of Research Resources (3)

Educational activities:
Type of activities: independent work
Number of hours:
per week: 4 **per level/semester:** 52
Form of the course: on-site learning, distance learning

Number of credits: 10

Recommended semester: 3.

Educational level: III.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 25

A	ABS	B	C	D	E	FX	NEABS
84,0	12,0	0,0	4,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Tomáš Blažek, PhD.

Last change: 02.06.2015

Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/3-FVM-108/15	Individual Study of Research Resources (4)

Educational activities:
Type of activities: independent work
Number of hours:
per week: 4 **per level/semester:** 52
Form of the course: on-site learning, distance learning

Number of credits: 10

Recommended semester: 4.

Educational level: III.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 24

A	ABS	B	C	D	E	FX	NEABS
87,5	8,33	0,0	0,0	4,17	0,0	0,0	0,0

Lecturers: doc. RNDr. Tomáš Blažek, PhD.

Last change: 02.06.2015

Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/3-FVM-204/15	Introduction to Quantum Processing of Information

Educational activities:
Type of activities: course
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning, distance learning

Number of credits: 10

Recommended semester:

Educational level: III.

Prerequisites:

Course requirements:
Continuous assessment: homework
Exam: test and oral
Indicative assessment scale: A 85%, B 70%, C 55%, D 40%, E 20%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Students will get acquainted with the basic principles of quantum information processing and quantum communication theory.

Class syllabus:
Fundamental concepts of quantum mechanics, basics of computer science, quantum logic networks, quantum Fourier transform, quantum search algorithms, physical implementation of quantum computers, CP maps and quantum processes, open quantum systems and decoherence, quantum communication channels and their capacity.

Recommended literature:
M. Nielsen and I.Chuang: Quantum Computation and Quantum Information (CUP, 2000)
J. Preskill: Quantum Computing (http://www.theory.caltech.edu/people/preskill/ph229/)

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 5

A	ABS	B	C	D	E	FX	NEABS
40,0	40,0	0,0	0,0	0,0	20,0	0,0	0,0

Lecturers: prof. RNDr. Vladimír Bužek, DrSc., doc. Mgr. Mário Ziman, PhD.

Last change: 15.03.2022

Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/3-FVM-007/10	Mathematical Methods of Theoretical Physics

Educational activities:
Type of activities: lecture
Number of hours:
per week: 4 **per level/semester:** 52
Form of the course: on-site learning, distance learning

Number of credits: 10

Recommended semester:

Educational level: III.

Prerequisites:

Course requirements:

Learning outcomes:
After the course students are prepared to use modern geometry in subjects appointed in Class syllabus.

Class syllabus:
Geometrical approach to hydrodynamics, Nöther's theorem, energy-momentum tensor, geometry of Kaluza-Klein, Einstein-Cartan and Cartan-Newton gravity, ...

Recommended literature:
M.Fecko: Differential geometry and Lie groups for physicists, Cambridge University Press, 2006,
M.Fecko: Modern geometry in not-so-high echelons of physics: Case studies,
Acta Physica Slovaca 63, No.5, 261 - 359 (2013) (arXiv:1406.0078)
Ch.Misner, Kip S.Thorne, J.A.Wheeler: Gravitation, W.H.Freeman, 1973

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 18

A	ABS	B	C	D	E	FX	NEABS
88,89	11,11	0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Marián Fecko, PhD.

Last change: 31.01.2022

Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/3-FVM-210/15	Mathematical Structures of Quantum Theory

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning, distance learning

Number of credits: 10

Recommended semester:

Educational level: III.

Prerequisites:

Course requirements:
Continuous assessment: homework
Exam: test and oral
Indicative assessment scale: A 85%, B 70%, C 55%, D 40%, E 20%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
The graduate of this course will be able to use mathematical tools and formalism of modern quantum theory.

Class syllabus:
1. Mathematical foundations (Hilbert spaces, transformation groups, convex sets, measure theory) 2. States and effects (density matrix, state space, duality, automorphism groups, Wigner theorem, Gleason's theorem) 3. Quantum observable (POVM, relations between observable , Naimark's theorem) 4. Quantum operations (complete positivity, Stinespring's theorem, Choi-Jamiolkowski isomorphism, quantum channels, Kraus representation) 5. Quantum measurement models (instruments, Luders measurements) 6. Quantum dynamics (control equations, Lindblad's equation)

Recommended literature:
T.Heinosaari, M.Ziman: Guide to mathematical concepts of quantum theory, Acta Physica Slovaca 58, 487-674 (2008)
T.Heinosaari, M.Ziman: The Mathematical Language of Quantum theory (Cambridge, 2012)

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 9

A	ABS	B	C	D	E	FX	NEABS
44,44	33,33	11,11	11,11	0,0	0,0	0,0	0,0

Lecturers: doc. Mgr. Mário Ziman, PhD.

Last change: 15.03.2022

Approved by:

STATE EXAM DESCRIPTION

Academic year: 2021/2022	
University: Comenius University Bratislava	
Faculty: Faculty of Mathematics, Physics and Informatics	
Course ID: FMFI.KTF/3-FVM-950/15	**Course title:** Passing Dissertation Examination
Number of credits: 20	
Recommended semester: 3., 4..	
Educational level: III.	
State exam syllabus:	
Last change: 12.10.2016	
Approved by:	

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/3-FVM-213/16	Quantization on Curved Backround and Hawking Radiation

Educational activities:
Type of activities: lecture / practicals
Number of hours:
per week: 2 / 1 **per level/semester:** 26 / 13
Form of the course: on-site learning, distance learning

Number of credits: 5

Recommended semester:

Educational level: III.

Prerequisites:

Course requirements:
continuous assessment: assignments; exam: not held (the course is optional)
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Graduates will understand the basic principles and techniques related to quantum field theory against a non-trivial gravitational background, and applications such as Hawking black hole radiation and others.

Class syllabus:
Quantum harmonic oscillator with forced oscillations as an analogy for the formation of particles in the presence of gravity, the construction of a certain physical intuition. Introduction to quantum field theory: Transition from a quantum hamonic oscillator to a free quantum (scalar) field. The concept of vacuum and particles and their ambiguity, the dependence of the number of particles on the observer. Quantum field theory in an expanding universe and particle formation. Uniformly accelerated observer in Minkowski spacetime, Rindler's coordinates, Unruh effect. Hawking radiation and its properties depending on the charge and momentum of a black hole, thermodynamics of black holes. Vacuum energy, Casimir effect, moving mirrors and particle formation.

Recommended literature:
basic:
V. F. Mukhanov, S. Winitzki: Introduction to Quantum Effects in Gravity (Cambridge University Press, Cambridge, 2007) (draft available at: https://sites.google.com/site/winitzki/sergei-winitzkis-files/book.pdf); additional:
L. E. Parker, D. J. Toms: Quantum Field Theory in Curved Spacetime. Quantized Fields and Gravity (Cambridge University Press, Cambridge, 2009)
N. D. Birrell, P. C. W. Davies: Quantum fields in curved space (Cambridge University Press, Cambridge, 1984).
L. Susskind, J. Lindesay: An Introduction To Black Holes, Information And The String Theory Revolution: The Holographic Universe (World Scientific Publishing Company, 2004)

Languages necessary to complete the course:
Czech (lecture), English (literature)

Notes:

Past grade distribution
Total number of evaluated students: 2

A	ABS	B	C	D	E	FX	NEABS
100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: Mgr. Petr Beneš, PhD.

Last change: 15.03.2022

Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KEF/3-FKL-007/15	Quantum Simulations in Condensed Matter

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning, distance learning

Number of credits: 10

Recommended semester:

Educational level: III.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 17

A	ABS	B	C	D	E	FX	NEABS
82,35	5,88	5,88	5,88	0,0	0,0	0,0	0,0

Lecturers: prof. Ing. Roman Martoňák, DrSc.

Last change: 02.06.2015

Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/3-FVM-209/15	Quantum Theory of Gravity

Educational activities:
Type of activities: lecture
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning, distance learning

Number of credits: 3

Recommended semester:

Educational level: III.

Prerequisites:

Recommended prerequisites:
2-FTF-117 General Theory of Relativity

Antirequisites: FMFI.KTFDF/2-FTF-222/00

Course requirements:
Exam: final work
Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
After completing the course, students will know the success to date on the way to combine quantum mechanics with general theory of relativity.

Class syllabus:
Hawking radiation (scalar field modes against a black hole, Hawking temperature), wave function of the universe (ADM formalism, diffeomorphism and Hamiltonian coupling, Hawking - Hartl boundary condition, minispace).

Recommended literature:
S. W. Hawking, Comm. Math. Phys. 43, 199 (1975);
J. B. Hartle, S. W. Hawking, Phys. Rev. D 28, 2960 (1983)

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 5

A	ABS	B	C	D	E	FX	NEABS
60,0	40,0	0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Vladimír Balek, CSc.

Last change: 15.03.2022
Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/3-FVM-004/15	Relativistic Quantum Field Theory

Educational activities:
Type of activities: lecture
Number of hours:
per week: 4 **per level/semester:** 52
Form of the course: on-site learning, distance learning

Number of credits: 10

Recommended semester:

Educational level: III.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 20

A	ABS	B	C	D	E	FX	NEABS
70,0	20,0	10,0	0,0	0,0	0,0	0,0	0,0

Lecturers: prof. RNDr. Peter Prešnajder, DrSc., doc. RNDr. Tomáš Blažek, PhD.

Last change: 02.06.2015

Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/3-FVM-301/10	Research Work (1)

Educational activities:
Type of activities: independent work
Number of hours:
per week: 10 **per level/semester:** 130
Form of the course: on-site learning, distance learning

Number of credits: 20

Recommended semester: 5.

Educational level: III.

Prerequisites:

Course requirements:
Ongoing evaluation based on homework
Approximate marking: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
The student will learn to work individually and in a team on a research project in the following areas: 1. Publishing activities, 2. Active presentation of results, 3. Grants, responses and others

Class syllabus:
independent active scientific activity based on the recommendation of the advisor
1. Work on a publication sent to a professional journal, conference proceedings, contribution to a collaborative note. Development of a new software product related to the dissertation. 2. Presentation at a conference, summer school, professional event, presentation of preliminary results at a departmental seminar or equivalent event for the named events. 3. Submission of a UK grant, participation of at least 20% in the submission of other research grants. The percentage will be confirmed by the advisor.

Recommended literature:
Selection of recent papers from the field relevant to the PhD work

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 23

A	ABS	B	C	D	E	FX	NEABS
86,96	13,04	0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Tomáš Blažek, PhD.

Last change: 31.03.2022
Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/3-FVM-302/10	Research Work (2)

Educational activities:
Type of activities: independent work
Number of hours:
per week: 12 **per level/semester:** 156
Form of the course: on-site learning, distance learning

Number of credits: 25

Recommended semester: 6.

Educational level: III.

Prerequisites:

Course requirements:
Ongoing evaluation based on homework Approximate marking: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
The student will learn to work individually and in a team on a research project in the following areas: 1. Publishing activities, 2. Active presentation of results, 3. Grants, responses and others

Class syllabus:
independent active scientific activity based on the recommendation of the advisor
1. Work on a publication sent to a professional journal, conference proceedings, contribution to a collaborative note. Development of a new software product related to the dissertation. 2. Presentation at a conference, summer school, professional event, presentation of preliminary results at a departmental seminar or equivalent event for the named events. 3. Submission of a UK grant, participation of at least 20% in the submission of other research grants. The percentage will be confirmed by the advisor.

Recommended literature:
Selection of recent papers from the field relevant to the PhD work

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 23

A	ABS	B	C	D	E	FX	NEABS
82,61	17,39	0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Tomáš Blažek, PhD.

Last change: 31.03.2022
Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/3-FVM-303/10	Research Work (3)

Educational activities:
Type of activities: independent work
Number of hours:
per week: 12 **per level/semester:** 156
Form of the course: on-site learning, distance learning

Number of credits: 25

Recommended semester: 7.

Educational level: III.

Prerequisites:

Course requirements:
Ongoing evaluation based on homework Approximate marking: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
The student will learn to work individually and in a team on a research project in the following areas: 1. Publishing activities, 2. Active presentation of results, 3. Grants, responses and others

Class syllabus:
independent active scientific activity based on the recommendation of the advisor
1. Work on a publication sent to a professional journal, conference proceedings, contribution to a collaborative note. Development of a new software product related to the dissertation. 2. Presentation at a conference, summer school, professional event, presentation of preliminary results at a departmental seminar or equivalent event for the named events. 3. Submission of a UK grant, participation of at least 20% in the submission of other research grants. The percentage will be confirmed by the advisor.

Recommended literature:
Selection of recent papers from the field relevant to the PhD work

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 21

A	ABS	B	C	D	E	FX	NEABS
80,95	19,05	0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Tomáš Blažek, PhD.

Last change: 31.03.2022
Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/3-FVM-304/10	Research Work (4)

Educational activities:
Type of activities: independent work
Number of hours:
per week: 10 **per level/semester:** 130
Form of the course: on-site learning, distance learning

Number of credits: 20

Recommended semester: 8.

Educational level: III.

Prerequisites:

Course requirements:
Ongoing evaluation based on homework Approximate marking: A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
The student will learn to work individually and in a team on a research project in the following areas: 1. Publishing activities, 2. Active presentation of results, 3. Grants, responses and others

Class syllabus:
independent active scientific activity based on the recommendation of the advisor
1. Work on a publication sent to a professional journal, conference proceedings, contribution to a collaborative note. Development of a new software product related to the dissertation. 2. Presentation at a conference, summer school, professional event, presentation of preliminary results at a departmental seminar or equivalent event for the named events. 3. Submission of a UK grant, participation of at least 20% in the submission of other research grants. The percentage will be confirmed by the advisor.

Recommended literature:
Selection of recent papers from the field relevant to the PhD work

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 16

A	ABS	B	C	D	E	FX	NEABS
75,0	25,0	0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Tomáš Blažek, PhD.

Last change: 31.03.2022

Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/3-FVM-207/15	Selected Non-perturbative Methods in the Quantum Field Theory

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 26
Form of the course: on-site learning, distance learning

Number of credits: 10

Recommended semester:

Educational level: III.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 3

A	ABS	B	C	D	E	FX	NEABS
100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: RNDr. Ľubomír Martinovič, CSc.

Last change: 14.03.2022

Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/3-FVM-208/15	Selected Topics in Mathematical Physics

Educational activities:
Type of activities: lecture
Number of hours:
per week: 3 **per level/semester:** 39
Form of the course: on-site learning, distance learning

Number of credits: 5

Recommended semester:

Educational level: III.

Prerequisites:

Antirequisites: FMFI.KTFDF/2-FTF-221/00

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 0

A	ABS	B	C	D	E	FX	NEABS
0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Pavel Bóna, CSc.

Last change: 02.06.2015

Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/3-FVM-212/15	Selected Topics in Quantum Theory of Information

Educational activities:
Type of activities: course
Number of hours:
per week: 3 **per level/semester:** 39
Form of the course: on-site learning, distance learning

Number of credits: 10

Recommended semester:

Educational level: III.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 8

A	ABS	B	C	D	E	FX	NEABS
37,5	50,0	12,5	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. Mgr. Mário Ziman, PhD., Mgr. Daniel Nagaj, PhD.

Last change: 02.06.2015

Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/3-FVM-801/10	Teaching Activities (1)

Educational activities:
Type of activities: other
Number of hours:
per week: 4 **per level/semester:** 52
Form of the course: on-site learning, distance learning

Number of credits: 10

Recommended semester: 1.

Educational level: III.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 15

A	ABS	B	C	D	E	FX	NEABS
93,33	6,67	0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Tomáš Blažek, PhD.

Last change: 02.06.2015

Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/3-FVM-802/10	Teaching Activities (2)

Educational activities:
Type of activities: other
Number of hours:
per week: 4 **per level/semester:** 52
Form of the course: on-site learning, distance learning

Number of credits: 10

Recommended semester: 2.

Educational level: III.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 15

A	ABS	B	C	D	E	FX	NEABS
93,33	6,67	0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Tomáš Blažek, PhD.

Last change: 02.06.2015

Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/3-FVM-803/10	Teaching Activities (3)

Educational activities:
Type of activities: other
Number of hours:
per week: 4 **per level/semester:** 52
Form of the course: on-site learning, distance learning

Number of credits: 10

Recommended semester: 3.

Educational level: III.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 15

A	ABS	B	C	D	E	FX	NEABS
100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Tomáš Blažek, PhD.

Last change: 02.06.2015

Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/3-FVM-804/10	Teaching Activities (4)

Educational activities:
Type of activities: other
Number of hours:
per week: 4 **per level/semester:** 52
Form of the course: on-site learning, distance learning

Number of credits: 10

Recommended semester: 4.

Educational level: III.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 15

A	ABS	B	C	D	E	FX	NEABS
100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Tomáš Blažek, PhD.

Last change: 02.06.2015

Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/3-FVM-805/10	Teaching Activities (5)

Educational activities:
Type of activities: other
Number of hours:
per week: 4 **per level/semester:** 52
Form of the course: on-site learning, distance learning

Number of credits: 10

Recommended semester: 5.

Educational level: III.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 9

A	ABS	B	C	D	E	FX	NEABS
100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Tomáš Blažek, PhD.

Last change: 02.06.2015

Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/3-FVM-806/10	Teaching Activities (6)

Educational activities:
Type of activities: other
Number of hours:
per week: 4 **per level/semester:** 52
Form of the course: on-site learning, distance learning

Number of credits: 10

Recommended semester: 6.

Educational level: III.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 9

A	ABS	B	C	D	E	FX	NEABS
100,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Tomáš Blažek, PhD.

Last change: 02.06.2015

Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/3-FVM-807/10	Teaching Activities (7)

Educational activities:
Type of activities: other
Number of hours:
per week: 4 **per level/semester:** 52
Form of the course: on-site learning, distance learning

Number of credits: 10

Recommended semester: 7.

Educational level: III.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 6

A	ABS	B	C	D	E	FX	NEABS
66,67	33,33	0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Tomáš Blažek, PhD.

Last change: 02.06.2015

Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KEF/3-FKL-006/15	Theory of Condensed Matter

Educational activities:
Type of activities: lecture / seminar
Number of hours:
per week: 2 / 2 **per level/semester:** 26 / 26
Form of the course: on-site learning, distance learning

Number of credits: 10

Recommended semester:

Educational level: III.

Prerequisites:

Recommended prerequisites:
2-FTL-107 Structure and mechanical properties of solids
2-FTL-108 Electronic and optical properties of solids
2-FTL-205 Many body physics

Course requirements:
homeworks + oral exam
A 90%, B 80%, C 70%, D 60%, E 50%
Scale of assessment (preliminary/final): 55/45

Learning outcomes:
The students will be able to formulate the many-body problems in the language of quantum field theory. They will know the basic principles of selected theoretical techniques used in condensed matter theory and they will know in which circumstances they can be applied.

Class syllabus:
Linear response theory and correlation functions. Green's functions: relation to observables, formal properties. Perturbation theory and Feynman diagrams. Adiabatic continuity, renormalization group, and effective Hamiltonians. Variational methods. Upon agreement with the students, these notions and methods will be illustrated in the context of quantum magnetism, superfluidity and superconductivity, disordered systems, correlated electrons, and/or coupled electron-phonon problems.

Recommended literature:
http://www.st.fmph.uniba.sk/~hlubina1/
Green’s functions and condensed matter / G. Rickayzen. Academic Press, 1980
Fundamentals of the Physics of Solids, Vols. 1-3 / J. Sólyom. Springer 2007 - 2010
Principles of condensed matter physics / P. M. Chaikin, T. C. Lubensky. Cambridge Univ. Press, 1995
Basic notions of condensed matter physics / P. W. Anderson. Addison Wesley, 1984

Languages necessary to complete the course:

english

Notes:

Past grade distribution
Total number of evaluated students: 28

A	ABS	B	C	D	E	FX	NEABS
78,57	21,43	0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Richard Hlubina, DrSc.

Last change: 19.01.2022

Approved by:

COURSE DESCRIPTION

Academic year: 2021/2022

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KTF/3-FVM-002/00	Theory of Gravitation and Cosmology

Educational activities:
Type of activities: lecture
Number of hours:
per week: 4 **per level/semester:** 52
Form of the course: on-site learning, distance learning

Number of credits: 10

Recommended semester:

Educational level: III.

Prerequisites:

Course requirements:

Learning outcomes:

Class syllabus:
- spherically symmetric stars and black holes
- linearized gravitation, gravitational waves
- expanding Universe and cosmological models

Recommended literature:
L. D. Landau, E. M. Lifshitz: Teoria polia, Nauka, Moskva (1973) [English translation: Oxford, Pergamon Press (1975)]
Ch. W. Misner, K. S. Thorne, J. A. Wheeler: Gravitation, W. H. Freeman and Comp., San Francisco (1973)

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 8

A	ABS	B	C	D	E	FX	NEABS
62,5	25,0	0,0	12,5	0,0	0,0	0,0	0,0

Lecturers: doc. RNDr. Vladimír Balek, CSc.

Last change: 02.06.2015

Approved by: