Course descriptions

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COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty:

Course ID:	**Course title:**
FMFI.KEF/3-FKL-007/24	Ab initio Modelling of Materials

Educational activities:
Type of activities: practicals / lecture
Number of hours:
per week: 1 / 2 **per level/semester:** 14 / 28
Form of the course: on-site learning, distance learning

Number of credits: 10

Recommended semester: 2.

Educational level: III.

Prerequisites:

Recommended prerequisites:
The course requires knowledge of standard classical MD/MC simulation methods on the level of the course FMFI.KEF/2-FTL-110/22 Computer simulations of condensed matter.

Course requirements:
At the end of the semester a simulation problem will be assigned and the student will provide a written report on the solution. The score will be based on the evaluation of the report. Minimal score: 50%
Scale of assessment (preliminary/final): 0/100

Learning outcomes:
The course provides an introduction to current methods of materials modeling based on ab initio approaches. It focuses on static and dynamical simulations (ab initio molecular dynamics) based on the density functional theory (DFT) for electrons and their applications to various condensed matter systems. Quantum Monte Carlo methods for electrons (Diffusion Monte Carlo) and ions (Path Integral Monte Carlo) will be mentioned too. Besides that new approaches to force-field generation based on machine learning will be shown, as well as other possible applications of machine learning in materials simulations. The methods will be illustrated on a number of examples and in the exercises the student will learn to use the freely available ab initio code Quantum Espresso.

Class syllabus:
materials modeling, structural prediction, calculation of properties
density functional theory (DFT), Hohenberg - Kohn theorems
Kohn - Sham method and equations
approximate DFT functionals - LDA, GGA, hybrid
practical approach to solving Kohn-Sham equations - plane-wave basis expansion of wavefunctions, pseudopotentials
ab initio molecular dynamics
evolutionary algorithms and crystal structure prediction
Diffusion Quantum Monte Carlo approach (DMC)
Path Integral Monte Carlo methods

machine-learning-based methods of generating force-fields
further applications of machine learning in materials simulations

Recommended literature:

F. Giustino, Materials Modelling using Density Functional Theory, Oxford University Press 2014
D.S. Sholl, J.A. Steckel, Density functional theory (A practical introduction), John Wiley & sons, 2009
Wolfram Koch, Max C. Holthausen, A Chemist's Guide to Density Functional Theory, 2001 Wiley#VCH Verlag GmbH

Languages necessary to complete the course:
Slovak, English

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: prof. Ing. Roman Martoňák, DrSc.

Last change: 26.08.2024

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty:

Course ID:	**Course title:**
FMFI.KEF/3-FKL-007/22	Ab initio Modelling of Materials

Educational activities:
Type of activities: practicals / lecture
Number of hours:
per week: 2 / 2 **per level/semester:** 28 / 28
Form of the course: on-site learning

Number of credits: 10

Recommended semester: 2.

Educational level: III.

Prerequisites:

Recommended prerequisites:
The course requires knowledge of standard classical MD/MC simulation methods on the level of the course FMFI.KEF/2-FTL-110/22 Computer simulations of condensed matter.

Course requirements:
At the end of the semester a simulation problem will be assigned and the student will provide a written report on the solution. The score will be based on the evaluation of the report. Minimal score: 50%
Scale of assessment (preliminary/final): 0/100

Learning outcomes:
The course provides an introduction to current methods of materials modeling based on ab initio approaches. It focuses on static and dynamical simulations (ab initio molecular dynamics) based on the density functional theory (DFT) for electrons and their applications to various condensed matter systems. Quantum Monte Carlo methods for electrons (Diffusion Monte Carlo) and ions (Path Integral Monte Carlo) will be mentioned too. Besides that new approaches to force-field generation based on machine learning will be shown, as well as other possible applications of machine learning in materials simulations. The methods will be illustrated on a number of examples and in the exercises the student will learn to use the freely available ab initio code Quantum Espresso.

Class syllabus:
materials modeling, structural prediction, calculation of properties
density functional theory (DFT), Hohenberg - Kohn theorems
Kohn - Sham method and equations
approximate DFT functionals - LDA, GGA, hybrid
practical approach to solving Kohn-Sham equations - plane-wave basis expansion of wavefunctions, pseudopotentials
ab initio molecular dynamics
evolutionary algorithms and crystal structure prediction
Diffusion Quantum Monte Carlo approach (DMC)
Path Integral Monte Carlo methods

machine-learning-based methods of generating force-fields
further applications of machine learning in materials simulations

Recommended literature:

F. Giustino, Materials Modelling using Density Functional Theory, Oxford University Press 2014
D.S. Sholl, J.A. Steckel, Density functional theory (A practical introduction), John Wiley & sons, 2009
Wolfram Koch, Max C. Holthausen, A Chemist's Guide to Density Functional Theory, 2001 Wiley#VCH Verlag GmbH

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
0,0	100,0	0,0	0,0	0,0	0,0	0,0	0,0

Lecturers: prof. Ing. Roman Martoňák, DrSc.

Last change: 01.02.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty:

Course ID:	**Course title:**
FMFI.KEF/3-FKL-601/24	Condensed Matter Physics Seminar

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 28
Form of the course: on-site 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: 8

ABS	NEABS
100,0	0,0

Lecturers: prof. Ing. Roman Martoňák, DrSc., doc. RNDr. Tomáš Plecenik, PhD.

Last change:

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty:

Course ID:	**Course title:**
FMFI.KEF/3-FKL-602/24	Condensed Matter Physics Seminar

Educational activities:
Type of activities: seminar
Number of hours:
per week: 2 **per level/semester:** 28
Form of the course: on-site 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: 2

ABS	NEABS
100,0	0,0

Lecturers: prof. Ing. Roman Martoňák, DrSc., doc. RNDr. Tomáš Plecenik, PhD.

Last change:

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty:

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:** 28
Form of the course: on-site learning, distance learning

Number of credits: 5

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: 239

A	ABS	B	C	D	E	FX	NEABS
35,15	61,09	0,42	0,0	0,0	1,67	0,0	1,67

Lecturers: Mgr. Simona Dobiašová, PhD., Mgr. Aneta Barnes

Last change: 13.01.2025

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty:

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:** 28
Form of the course: on-site learning, distance learning

Number of credits: 5

Recommended semester: 2.

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: 210

A	ABS	B	C	D	E	FX	NEABS
41,9	52,38	0,0	0,0	0,0	0,0	0,0	5,71

Lecturers: Mgr. Simona Dobiašová, PhD., Mgr. Aneta Barnes

Last change: 13.01.2025

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty:

Course ID:	**Course title:**
FMFI.KEF/3-FKL-811/24	Direct Teaching Activities

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 28
Form of the course: on-site 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: 5

ABS	NEABS
100,0	0,0

Lecturers:

Last change:

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty:

Course ID:	**Course title:**
FMFI.KEF/3-FKL-812/24	Direct Teaching Activities

Educational activities:
Type of activities: practicals
Number of hours:
per week: 2 **per level/semester:** 28
Form of the course: on-site 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: 2

ABS	NEABS
100,0	0,0

Lecturers:

Last change:

Approved by: prof. Ing. Roman Martoňák, DrSc.

STATE EXAM DESCRIPTION

Academic year: 2026/2027	
University: Comenius University Bratislava	
Faculty:	
Course ID: FMFI.KEF/3-FKL-950/15	**Course title:** Dissertation Examination
Number of credits: 20	
Educational level: III.	
State exam syllabus:	
Last change: 02.06.2015	
Approved by: prof. Ing. Roman Martoňák, DrSc.	

STATE EXAM DESCRIPTION

Academic year: 2026/2027	
University: Comenius University Bratislava	
Faculty:	
Course ID: FMFI.KEF/3-FKL-990/15	**Course title:** Dissertation Thesis Defense
Number of credits: 30	
Educational level: III.	
State exam syllabus:	
Last change: 02.06.2015	
Approved by: prof. Ing. Roman Martoňák, DrSc.	

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty:

Course ID:	**Course title:**
FMFI.KEF/3-FKL-003/22	Electrons in Disordered and Mesoscopic Systems

Educational activities:
Type of activities: seminar / lecture
Number of hours:
per week: 2 / 2 **per level/semester:** 28 / 28
Form of the course: on-site learning

Number of credits: 10

Recommended semester: 2.

Educational level: III.

Prerequisites:

Course requirements:
The form of the evaluation: written test and oral exam.
Minimal score: 50%
Scale of assessment (preliminary/final): 0/100

Learning outcomes:
After completing the course the student will gain knowledge of basic theoretical methods and experimental facts from the field of quantum electron transport in mesoscopic and disordered systems. He/she will be able to understand physical principles of nanoelectronics devices at the edge of miniaturisation.

Class syllabus:
Persistent current in mesoscopic conducting ring with normal electrons. Electron conductance of weakly-disordered conductor: Lorentz-Drude conductance as a semiclassical limit of quantum transport, quantum transport corrections – Altshuler-Aronov effect and weak localization. Tunneling spectroscopy of weakly disordered conductor – Altshuler-Aronov pseudogap. Single-electron tunneling and Coulomb blockade. Two-dimensional relativistic physics of graphene and boron nitride: tight-binding calculation of electron spectrum, effective description by two-dimensional Dirac equation - relativistic massless and massive fermions, analogy with Dirac equation in three dimensions. Electron transport in graphene, relativistic quantum Hall effect.

Recommended literature:
S. Datta, Electronic Transport in Mesoscopic Systems (Cambridge University Press, Cambridge, UK, 1995).
P.A.Mello, N.Kumar, Quantum Transport in Mesoscopic Physics - Complexity and Statistical Fluctuations, Oxford University Press, 2005, pp. 401, ISBN 0-19-852582-6
M. Moško a A. Mošková , Úvod do mezoskopickej fyziky (in slovak), http://kflin.elf.stuba.sk/~ballo/SimLab/skripta

Languages necessary to complete the course:
The course is held in Slovak (in English when necessary)

Notes:	
Past grade distribution Total number of evaluated students: 3	
ABS	NEABS
100,0	0,0
Lecturers: doc. RNDr. Martin Moško, DrSc.	
Last change: 01.02.2022	
Approved by: prof. Ing. Roman Martoňák, DrSc.	

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty:

Course ID:	**Course title:**
FMFI.KEF/3-FKL-003/24	Electrons in Disordered and Mesoscopic Systems

Educational activities:
Type of activities: lecture
Number of hours:
per week: 3 **per level/semester:** 42
Form of the course: on-site learning

Number of credits: 10

Recommended semester: 2.

Educational level: III.

Prerequisites:

Course requirements:
The form of the evaluation: written test and oral exam.
Minimal score: 50%
Scale of assessment (preliminary/final): 0/100

Learning outcomes:
After completing the course the student will gain knowledge of basic theoretical methods and experimental facts from the field of quantum electron transport in mesoscopic and disordered systems. He/she will be able to understand physical principles of nanoelectronics devices at the edge of miniaturisation.

Class syllabus:
Persistent current in mesoscopic conducting ring with normal electrons. Electron conductance of weakly-disordered conductor: Lorentz-Drude conductance as a semiclassical limit of quantum transport, quantum transport corrections – Altshuler-Aronov effect and weak localization. Tunneling spectroscopy of weakly disordered conductor – Altshuler-Aronov pseudogap. Single-electron tunneling and Coulomb blockade. Two-dimensional relativistic physics of graphene and boron nitride: tight-binding calculation of electron spectrum, effective description by two-dimensional Dirac equation - relativistic massless and massive fermions, analogy with Dirac equation in three dimensions. Electron transport in graphene, relativistic quantum Hall effect.

Recommended literature:
S. Datta, Electronic Transport in Mesoscopic Systems (Cambridge University Press, Cambridge, UK, 1995).
P.A.Mello, N.Kumar, Quantum Transport in Mesoscopic Physics - Complexity and Statistical Fluctuations, Oxford University Press, 2005, pp. 401, ISBN 0-19-852582-6
M. Moško a A. Mošková , Úvod do mezoskopickej fyziky (in slovak), http://kflin.elf.stuba.sk/~ballo/SimLab/skripta

Languages necessary to complete the course:
The course is held in Slovak (in English when necessary)

Notes:	
Past grade distribution Total number of evaluated students: 2	
ABS	NEABS
100,0	0,0
Lecturers: doc. RNDr. Martin Moško, DrSc.	
Last change: 26.08.2024	
Approved by: prof. Ing. Roman Martoňák, DrSc.	

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty:

Course ID:	**Course title:**
FMFI.KEF/3-FKL-401/24	Foreign Periodical Cited in Current Contents

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

Number of credits: 40

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: 24

ABS	NEABS
100,0	0,0

Lecturers:

Last change: 26.08.2024

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty:

Course ID:	**Course title:**
FMFI.KEF/3-FKL-401/10	Foreign Periodical Cited in Current Contents

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

Number of credits: 35

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: 23

ABS	NEABS
100,0	0,0

Lecturers:

Last change: 02.06.2015

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027	
University: Comenius University Bratislava	
Faculty:	
Course ID: FMFI.KEF/3-FKL-402/10	**Course title:** Home Journal Cited in Current Contents
Educational activities: **Type of activities:** **Number of hours:** **per week:** **per level/semester:** **Form of the course:** on-site learning	
Number of credits: 30	
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: 0

ABS	NEABS
0,0	0,0

Lecturers:
Last change: 02.06.2015
Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty:

Course ID:	**Course title:**
FMFI.KEF/3-FKL-102/15	Individual Study of Resources (1)

Educational activities:
Type of activities: independent work
Number of hours:
per week: 10 **per level/semester:** 140
Form of the course: on-site 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: 20

ABS	NEABS
100,0	0,0

Lecturers:

Last change:

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty:

Course ID:	**Course title:**
FMFI.KEF/3-FKL-103/15	Individual Study of Resources (2)

Educational activities:
Type of activities: independent work
Number of hours:
per week: 10 **per level/semester:** 140
Form of the course: on-site 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: 17

ABS	NEABS
100,0	0,0

Lecturers:

Last change:

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty:

Course ID:	**Course title:**
FMFI.KEF/3-FKL-010/24	Modern Experimental Methods in Condensed Matter Physics (1)

Educational activities:
Type of activities: seminar / lecture
Number of hours:
per week: 2 / 1 **per level/semester:** 28 / 14
Form of the course: on-site learning

Type, volume, methods and workload of the student - additional information
1 / 2 (lecture / seminar)

Number of credits: 10

Recommended semester: 1.

Educational level: III.

Prerequisites:

Course requirements:
Continuous assessment: laboratory assignments
Exam: oral
Minimal score: 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Gaining practical (hands-on) experience with modern experimental methods used in the condensed matter physics. Learning the methodology for independent design and implementation of experiments necessary for the realization of the dissertation.

Class syllabus:
Preparation of metallic, semiconducting, insulating, superconducting and hard thin films and coatings by various PVD methods (pulsed laser deposition, magnetron sputtering, evaporation).
Preparation of thin film micro/nano structures using optical lithography, electron beam lithography, focused ion beam, etc.
Characterization of films and micro/nano structures using laser scanning confocal microscopy, ellipsometry, atomic force microscopy, scanning electron microscopy and energy-dispersive X-ray spectroscopy.
The schedule will be adjusted individually according to the topic of the student's dissertation.

Recommended literature:
Recommended literature:
M. Ohring: Materials Science of Thin Films – Deposition and Structure, Academic Press, 2002
D.L. Smith, Thin film deposition, principles and practice, McGraw-Hill, 1995
P. M. Martin: Handbook of Deposition Technologies for Films and Coatings, Elsevier, 2005
E.Mayer, H.J.Hug, R.Bennewitz, Scanning Probe Microscopy: The Lab on a Tip, Springer, 2004, pp. 210, ISBN 3-540-43180-2

Metody analýzy povrchů / F. Allmer ...[et al.]; editorka Ludmila Eckertová. Praha : Československá akademie věd , 1990

Languages necessary to complete the course:
Slovak or English

Notes:

Past grade distribution
Total number of evaluated students: 3

ABS	NEABS
100,0	0,0

Lecturers: doc. RNDr. Tomáš Plecenik, PhD.

Last change: 09.02.2026

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty:

Course ID:	**Course title:**
FMFI.KEF/3-FKL-009/24	Modern Experimental Methods in Condensed Matter Physics (2)

Educational activities:
Type of activities: seminar / lecture
Number of hours:
per week: 2 / 1 **per level/semester:** 28 / 14
Form of the course: on-site learning

Type, volume, methods and workload of the student - additional information
1 / 2 (lecture / seminar)

Number of credits: 10

Recommended semester: 2.

Educational level: III.

Prerequisites:

Course requirements:
Continuous assessment: laboratory assignments
Exam: oral
Minimal score: 50%
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
Gaining practical (hands-on) experience with modern experimental methods used in the condensed matter physics. Learning the methodology for independent design and implementation of experiments necessary for the realization of the dissertation.

Class syllabus:
Characterization of the structure and composition of thin films and thin-film micro/nano structures using:
- X-ray diffraction and reflectivity
- X-ray photoelectron spectroscopy and Auger spectroscopy
Characterization of mechanical, electrical and magnetic properties of thin films and thin film micro/nano structures using:
- nanoindentation and ball-on-disk methods
- advanced scanning probe microscopy methods (SSRM, KPFM, etc.)
- various methods of measurement of electrical transport properties and magnetic properties in a wide range of temperatures and magnetic fields
The schedule will be adjusted individually according to the topic of the student's dissertation.

Recommended literature:
Odporúčaná literatúra:
V.Valvoda, M.Polcarová, P. Lukáč, Základy strukturní analýzy, Karolinum, Praha, 1992, pp. 492, ISBN 80-7066-648-X

J.F. Watts, J. Wolstenholme, An introduction to surface analysis by XPS and AES, John Wiley & Sons, 2003, pp. 212, ISBN 978-0-470-84713-8
Scanning probe microscopy and spectroscopy, ed. D.A.Bonnel, John Willey & Sons, New York, 2001, pp. 493, ISBN 0-471-24824-X
E.Mayer, H.J.Hug, R.Bennewitz, Scanning Probe Microscopy: The Lab on a Tip, Springer, 2004, pp. 210, ISBN 3-540-43180-2
M.Birkholz, Thin film analysis by X-ray scattering, Wiley-VCH Verlag GmbH, Weinheim, 2006, pp. 356, ISBN 3-527-31052-5
T.L.Alford, L.C.Feldman, J.W.Mayer, Fundamentals of Nanoscale Film Analysis, Springer, 2007, pp. 336, ISBN 978-0-387-29260-1
A.S. Morris, Measurement and Instrumentation principles, Elsevier, Amsterdam, 2001, pp.475, ISBN 0-7506-5081-8
R.B. Northrop, Introduction to instrumentation and measurement, Taylor&Francis, London, 2005, pp.743, ISBN 0-8493-3773-9
KEITHLEY: Nanotechnology Measurement Handbook
KEITHLEY: Making precision Low Current and High Resistance Measurements

Languages necessary to complete the course:
Slovak or English

Notes:

Past grade distribution
Total number of evaluated students: 0

ABS	NEABS
0,0	0,0

Lecturers: doc. RNDr. Tomáš Plecenik, PhD.

Last change: 09.02.2026

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty:

Course ID:	**Course title:**
FMFI.KEF/3-FKL-005/22	Modern Trends in Condensed Matter Physics and Acoustics

Educational activities:
Type of activities: seminar / lecture
Number of hours:
per week: 2 / 2 **per level/semester:** 28 / 28
Form of the course: on-site learning

Number of credits: 10

Recommended semester: 3.

Educational level: III.

Prerequisites:

Course requirements:
Continuous assessment: homework assignments
Exam: oral
minimal score: 50%

Learning outcomes:
Gain theoretical and practical knowledge of the latest trends in condensed matter physics and acoustics. Acquire the methodology for independent design and implementation of experiments necessary for the implementation of the dissertation.

Class syllabus:
Methods of preparation of thin films of various types: semiconductor, superconductor, metal, magnetoresistive and other coatings based on metals, nanolayers, layers for optoelectronics, etc. Surface treatment of substrates by various physical processes. Layer characterization.

Recommended literature:
The latest professional scientific articles and publications.

Languages necessary to complete the course:
Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 1

ABS	NEABS
100,0	0,0

Lecturers: prof. RNDr. Peter Kúš, DrSc.

Last change: 02.02.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027	
University: Comenius University Bratislava	
Faculty:	
Course ID: FMFI.KEF/3-FKL-701/10	**Course title:** Obtaining a University Grant
Educational activities: **Type of activities:** **Number of hours:** **per week:** **per level/semester:** **Form of the course:** on-site learning	
Number of credits: 20	
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: 12

ABS	NEABS
100,0	0,0

Lecturers:
Last change: 02.06.2015
Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty:

Course ID:	**Course title:**
FMFI.KEF/3-FKL-008/22	Quantum Measurements and Technologies

Educational activities:
Type of activities: practicals / lecture
Number of hours:
per week: 2 / 2 **per level/semester:** 28 / 28
Form of the course: on-site learning

Number of credits: 10

Recommended semester: 3.

Educational level: III.

Prerequisites:

Recommended prerequisites:
Master in physics or equivalent

Course requirements:
The evaluation of the course will be in the form of oral exam (1/2-1 h), its successful completion reflects the student's knowledge of physical principles of quantum-limited measurements and his ability to design and measure quantum devices.
The lowest passing mark: 50%
Scale of assessment (preliminary/final): 45/55

Learning outcomes:
The student who completes the course successfully will have the ability to master the physical principles of quantum-limited measurements and will be able to use this knowledge for applications in quantum technologies. He or she will be able to design quantum superconducting devices with applications in quantum cryptography, quantum computers and simulators.

Class syllabus:
Quantum measurements. Standard quantum limit. Backaction of measuring device on the measured object. Electron as a quantum probe. Quantum nondemolition measurements. Linear measurements. Discrete and continuous quantum measurements. Parametric transducers and amplifiers. Squeezed states. Two-level quantum systems (qubits). Superconducting qubits. Single-photon detectors. Quantum cryptography and internet. Quantum computers and simulators.

Recommended literature:
1. V.B.Braginsky,F.Ya. Khalili, Kip S. Thorn, Quantum Measurement,
ISBN-10: 052141928X
2. Quantum Machines - Measurement and Control of Engineered Quantum Systems, Oxford University Press 2014, ISBN 978–0–19–968118–1
3. Single-Photon Generation and Detection, Elsevier Inc. 2013,
ISBN: 978-0-12-387695-9

Languages necessary to complete the course:

Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 7

ABS	NEABS
100,0	0,0

Lecturers: prof. RNDr. Miroslav Grajcar, DrSc., Mgr. Pavol Neilinger, PhD.

Last change: 02.02.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty:

Course ID:	**Course title:**
FMFI.KEF/3-FKL-008/24	Quantum Measurements and Technologies

Educational activities:
Type of activities: lecture
Number of hours:
per week: 3 **per level/semester:** 42
Form of the course: on-site learning

Number of credits: 10

Recommended semester: 3.

Educational level: III.

Prerequisites:

Recommended prerequisites:
Master in physics or equivalent

Course requirements:
The evaluation of the course will be in the form of oral exam (1/2-1 h), its successful completion reflects the student's knowledge of physical principles of quantum-limited measurements and his ability to design and measure quantum devices.
The lowest passing mark: 50%
Scale of assessment (preliminary/final): 45/55

Learning outcomes:
The student who completes the course successfully will have the ability to master the physical principles of quantum-limited measurements and will be able to use this knowledge for applications in quantum technologies. He or she will be able to design quantum superconducting devices with applications in quantum cryptography, quantum computers and simulators.

Class syllabus:
Quantum measurements. Standard quantum limit. Backaction of measuring device on the measured object. Electron as a quantum probe. Quantum nondemolition measurements. Linear measurements. Discrete and continuous quantum measurements. Parametric transducers and amplifiers. Squeezed states. Two-level quantum systems (qubits). Superconducting qubits. Single-photon detectors. Quantum cryptography and internet. Quantum computers and simulators.

Recommended literature:
1. V.B.Braginsky,F.Ya. Khalili, Kip S. Thorn, Quantum Measurement,
ISBN-10: 052141928X
2. Quantum Machines - Measurement and Control of Engineered Quantum Systems, Oxford University Press 2014, ISBN 978–0–19–968118–1
3. Single-Photon Generation and Detection, Elsevier Inc. 2013,
ISBN: 978-0-12-387695-9

Languages necessary to complete the course:

Slovak, English

Notes:

Past grade distribution
Total number of evaluated students: 3

ABS	NEABS
100,0	0,0

Lecturers: prof. RNDr. Miroslav Grajcar, DrSc., Mgr. Pavol Neilinger, PhD.

Last change: 26.08.2024

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

<table>
<tr><td colspan="2">Academic year: 2026/2027</td></tr>
<tr><td colspan="2">University: Comenius University Bratislava</td></tr>
<tr><td colspan="2">Faculty:</td></tr>
<tr><td>Course ID:
FMFI.KEF/3-FKL-702/10</td><td>Course title:
Quotation Registered in SCI or SCOPUS</td></tr>
<tr><td colspan="2">Educational activities:
Type of activities:
Number of hours:
per week: per level/semester:
Form of the course: on-site learning</td></tr>
<tr><td colspan="2">Number of credits: 4</td></tr>
<tr><td colspan="2">Recommended semester:</td></tr>
<tr><td colspan="2">Educational level: III.</td></tr>
<tr><td colspan="2">Prerequisites:</td></tr>
<tr><td colspan="2">Course requirements:</td></tr>
<tr><td colspan="2">Learning outcomes:</td></tr>
<tr><td colspan="2">Class syllabus:</td></tr>
<tr><td colspan="2">Recommended literature:</td></tr>
<tr><td colspan="2">Languages necessary to complete the course:</td></tr>
<tr><td colspan="2">Notes:</td></tr>
<tr><td colspan="2">Past grade distribution
Total number of evaluated students: 4</td></tr>
<tr><td colspan="2"><table>
<tr><td>ABS</td><td>NEABS</td></tr>
<tr><td>100,0</td><td>0,0</td></tr>
</table></td></tr>
<tr><td colspan="2">Lecturers:</td></tr>
<tr><td colspan="2">Last change: 02.06.2015</td></tr>
<tr><td colspan="2">Approved by: prof. Ing. Roman Martoňák, DrSc.</td></tr>
</table>

COURSE DESCRIPTION

Academic year: 2026/2027	
University: Comenius University Bratislava	
Faculty:	
Course ID: FMFI.KEF/3-FKL-302/10	**Course title:** Research Work
Educational activities: **Type of activities:** **Number of hours:** **per week:** **per level/semester:** **Form of the course:** on-site 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: 14

ABS	NEABS
100,0	0,0

Lecturers:
Last change: 02.06.2015
Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty:

Course ID:	**Course title:**
FMFI.KEF/3-FKL-303/10	Research Work

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

Number of credits: 20

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: 12

ABS	NEABS
100,0	0,0

Lecturers:

Last change: 02.06.2015

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027	
University: Comenius University Bratislava	
Faculty:	
Course ID: FMFI.KEF/3-FKL-304/10	**Course title:** Research Work
Educational activities: **Type of activities:** **Number of hours:** **per week:** **per level/semester:** **Form of the course:** on-site learning	
Number of credits: 25	
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: 16

ABS	NEABS
100,0	0,0

Lecturers:
Last change: 02.06.2015
Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027	
University: Comenius University Bratislava	
Faculty:	
Course ID: FMFI.KEF/3-FKL-304/24	**Course title:** Research Work
Educational activities: **Type of activities:** **Number of hours:** **per week:** **per level/semester:** **Form of the course:** on-site learning	
Number of credits: 20	
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: 2

ABS	NEABS
100,0	0,0

Lecturers:
Last change: 26.08.2024
Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027	
University: Comenius University Bratislava	
Faculty:	
Course ID: FMFI.KEF/3-FKL-305/24	**Course title:** Research Work
Educational activities: **Type of activities:** **Number of hours:** **per week:** **per level/semester:** **Form of the course:** on-site learning	
Number of credits: 20	
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: 2	

ABS	NEABS
100,0	0,0

Lecturers:
Last change: 26.08.2024
Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027	
University: Comenius University Bratislava	
Faculty:	
Course ID: FMFI.KEF/3-FKL-305/10	**Course title:** Research Work
Educational activities: **Type of activities:** **Number of hours:** **per week:** **per level/semester:** **Form of the course:** on-site learning	
Number of credits: 25	
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: 16	

ABS	NEABS
100,0	0,0

Lecturers:
Last change: 02.06.2015
Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty:

Course ID:	**Course title:**
FMFI.KEF/3-FKL-306/10	Research Work

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

Number of credits: 25

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: 18

ABS	NEABS
100,0	0,0

Lecturers:

Last change: 02.06.2015

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027	
University: Comenius University Bratislava	
Faculty:	
Course ID: FMFI.KEF/3-FKL-403/10	**Course title:** Reviewed Foreign Papers Volume
Educational activities: **Type of activities:** **Number of hours:** **per week:** **per level/semester:** **Form of the course:** on-site learning	
Number of credits: 25	
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: 2

ABS	NEABS
100,0	0,0

Lecturers:
Last change: 02.06.2015
Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027	
University: Comenius University Bratislava	
Faculty:	
Course ID: FMFI.KEF/3-FKL-404/10	**Course title:** Reviewed Home Papers Volume
Educational activities: **Type of activities:** **Number of hours:** **per week:** **per level/semester:** **Form of the course:** on-site learning	
Number of credits: 20	
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: 5

ABS	NEABS
100,0	0,0

Lecturers:
Last change: 02.06.2015
Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027	
University: Comenius University Bratislava	
Faculty:	
Course ID: FMFI.KEF/3-FKL-813/24	**Course title:** Supervision of Bachelor Thesis
Educational activities: **Type of activities:** **Number of hours:** **per week:** **per level/semester:** **Form of the course:** on-site 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: 0

ABS	NEABS
0,0	0,0

Lecturers:
Last change:
Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty:

Course ID:	**Course title:**
FMFI.KEF/3-FKL-814/24	Supervision of Student Scientific Conference

Educational activities:
Type of activities:
Number of hours:
per week: **per level/semester:**
Form of the course: on-site 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: 0

ABS	NEABS
0,0	0,0

Lecturers:

Last change:

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty:

Course ID:	**Course title:**
FMFI.KEF/3-FKL-801/10	Teaching Activities

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

Number of credits: 2

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: 8

ABS	NEABS
100,0	0,0

Lecturers:

Last change: 02.06.2015

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027	
University: Comenius University Bratislava	
Faculty:	
Course ID: FMFI.KEF/3-FKL-802/10	**Course title:** Teaching Activities
Educational activities: **Type of activities:** **Number of hours:** **per week:** **per level/semester:** **Form of the course:** on-site learning	
Number of credits: 2	
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: 4	

ABS	NEABS
100,0	0,0

Lecturers:
Last change: 02.06.2015
Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027	
University: Comenius University Bratislava	
Faculty:	
Course ID: FMFI.KEF/3-FKL-803/10	**Course title:** Teaching Activities
Educational activities: **Type of activities:** **Number of hours:** **per week:** **per level/semester:** **Form of the course:** on-site learning	
Number of credits: 2	
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: 8	

ABS	NEABS
100,0	0,0

Lecturers:
Last change: 02.06.2015
Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty:

Course ID:	**Course title:**
FMFI.KEF/3-FKL-804/10	Teaching Activities

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

Number of credits: 2

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: 4

ABS	NEABS
100,0	0,0

Lecturers:

Last change: 02.06.2015

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027	
University: Comenius University Bratislava	
Faculty:	
Course ID: FMFI.KEF/3-FKL-805/10	**Course title:** Teaching Activities
Educational activities: **Type of activities:** **Number of hours:** **per week:** **per level/semester:** **Form of the course:** on-site learning	
Number of credits: 2	
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: 8	

ABS	NEABS
100,0	0,0

Lecturers:
Last change: 02.06.2015
Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027	
University: Comenius University Bratislava	
Faculty:	
Course ID: FMFI.KEF/3-FKL-806/10	**Course title:** Teaching Activities
Educational activities: **Type of activities:** **Number of hours:** **per week:** **per level/semester:** **Form of the course:** on-site learning	
Number of credits: 2	
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: 5

ABS	NEABS
100,0	0,0

Lecturers:
Last change: 02.06.2015
Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027	
University: Comenius University Bratislava	
Faculty:	
Course ID: FMFI.KEF/3-FKL-807/10	**Course title:** Teaching Activities
Educational activities: **Type of activities:** **Number of hours:** **per week:** **per level/semester:** **Form of the course:** on-site learning	
Number of credits: 2	
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	

ABS	NEABS
100,0	0,0

Lecturers:
Last change: 02.06.2015
Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027	
University: Comenius University Bratislava	
Faculty:	
Course ID: FMFI.KEF/3-FKL-808/10	**Course title:** Teaching Activities
Educational activities: **Type of activities:** **Number of hours:** **per week:** **per level/semester:** **Form of the course:** on-site learning	
Number of credits: 2	
Recommended semester: 8.	
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: 0	

ABS	NEABS
0,0	0,0

Lecturers:
Last change: 02.06.2015
Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty:

Course ID:	**Course title:**
FMFI.KEF/3-FKL-006/22	Theory of Condensed Matter

Educational activities:
Type of activities: seminar / lecture
Number of hours:
per week: 2 / 2 **per level/semester:** 28 / 28
Form of the course: on-site learning

Number of credits: 10

Recommended semester: 1.

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:
seminars, homeworks + oral exam
minimal score: 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: 6

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

Lecturers: doc. RNDr. Richard Hlubina, DrSc.

Last change: 01.02.2022

Approved by: prof. Ing. Roman Martoňák, DrSc.

COURSE DESCRIPTION

Academic year: 2026/2027

University: Comenius University Bratislava

Faculty:

Course ID:	**Course title:**
FMFI.KEF/3-FKL-006/24	Theory of Condensed Matter

Educational activities:
Type of activities: lecture
Number of hours:
per week: 3 **per level/semester:** 42
Form of the course: on-site learning, distance learning

Number of credits: 10

Recommended semester: 1.

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:
seminars, homeworks + oral exam
minimal score: 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: 3

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

Lecturers: doc. RNDr. Richard Hlubina, DrSc.

Last change: 26.08.2024

Approved by: prof. Ing. Roman Martoňák, DrSc.