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COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-805/22	Assistance in Conference Organizing Committee

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

Number of credits: 5

Recommended semester:

Educational level: III.

Prerequisites:

Course requirements:

Learning outcomes:
Assistance in organizing a conference.

Class syllabus:
Active participation in the organization of a conference.

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: 05.09.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAMŠ/3-FBF-014/22	Biomatematics

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

Number of credits: 10

Recommended semester: 1.

Educational level: III.

Prerequisites:

Course requirements:
The evaluation of the course will be in the form of a continuous (individual work) and final evaluation (oral exam). Successful completion of the course reflects sufficient orientation of the student in the issue. The course will be classified as a graduate provided that the doctoral student proves the fulfilment of obligations at the level of at least 51%. The conditions for successful completion of the course are in accordance with the Study Regulations of the Faculty of Mathematics, Physics and Informatics.

Learning outcomes:
Students will learn about the theory and techniques used in current research on problems in mathematical biology and, in general, in mathematical models in the natural and social sciences. At the same time, students will try to work on a separate project in this area. They will also gain new insights into population models, chemical kinetics and cell biology.

Class syllabus:
Principles of mathematical modeling, modeling goals, modelling, model simulation, selection of parameters, non-dimensionalization, testing of model robustness, analysis of results. Biochemical kinetics, enzymatic reactions, co-operation, quasi-sufficiency approximation. Epidemiological models. Dynamics on neuronal and other cell membranes, Hodgkin-Huxley model, Fitzhugh-Nagum model.

Recommended literature:
A Primer on mathematical models in biology / Lee A. Segel, Leah Edelstein-Keshet. Philadelphia, Pa. : Society for Industrial and Applied Mathematics, 2013.
Mathematical biology: 1. An introduction / J. D. Murray. New York: Springer, 2002.
Mathematical biology: 2. Spatial models and biomedical applications / J. D. Murray. New York : Springer, 2003.
Nonlinear dynamics and chaos: with applications to physics, biology, chemistry, and engineering / Steven H. Strogatz. Cambridge : Perseus Books, 1998.

Languages necessary to complete the course:

Notes:	
Past grade distribution Total number of evaluated students: 1	
ABS	NEABS
100,0	0,0
Lecturers: doc. Mgr. Richard Kollár, PhD.	
Last change: 31.08.2022	
Approved by: prof. RNDr. Melánia Babincová, DrSc.	

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/3-FBF-015/22	Biomedical Applications of Plasma and Electric Fields

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

Type, volume, methods and workload of the student - additional information
The evaluation of the course will be in the form of a continuous (individual work) and final evaluation (oral exam). Successful completion of the course reflects sufficient orientation of the student in the issue. The course will be classified as a graduate provided that the doctoral student proves the fulfilment of obligations at the level of at least 51%. The conditions for successful completion of the course are in accordance with the Study Regulations of the Faculty of Mathematics, Physics and Informatics.

Number of credits: 10

Recommended semester: 6.

Educational level: III.

Prerequisites:

Course requirements:
Scale of assessment (preliminary/final): 30/70

Learning outcomes:
By completing the course, the student will gain a comprehensive overview of selected biomedical applications and therapeutic methods and an understanding of their principles, where various types of plasma and electrical discharges and pulsed electric fields are used.

Class syllabus:
Basic concepts of plasma physics, plasma formation, the principle of generating low-temperature plasma in electric discharges. Brief overview of low temperature plasma applications.
Low-temperature plasma and pulsed electric fields for biological decontamination and sterilization of microorganisms (bacteria, spores, yeasts, biofilms) in air, water, surfaces, medical instruments, in living organisms. Comparison with thermal and chemical methods of disinfection / sterilization. Food spoilage prevention. Medical in-vivo, ex-vivo and in-vitro applications of plasma, plasma surgery, treatment of skin diseases, disinfection and wound healing, tooth decay and root canals. Induction of apoptosis and cancer treatment, cell manipulation.
Interaction of fluids with plasma and plasma activated fluids. Cell interaction with plasma, plasma activated fluid and pulsed electric field. Induced cellular and systemic processes in organisms. Importance of reactive oxygen and nitrogen forms, electroporation and electropermabilization of cell membranes, effects of UV and vis radiation. Bio-compatible and antimicrobial plasma surface treatment.

Recommended literature:

• M. Laroussi et al. (eds.): Plasma medicine: applications of low-temperature gas plasmas in medicine and biology. Cambridge University Press, 2012
• Fridman and G. Friedman: Plasma medicine, Wiley 2013
• Z. Machala; K. Hensel; Y. Akishev (Eds.): Plasma for Bio-Decontamination, Medicine and Food Security, NATO Science for Peace and Security Series A: Chemistry and Biology, Springer 2012
• H-R. Metelmann, T. von Woedtke, K-D. Weltmann: Comprehensive Clinical Plasma Medicine, Springer 2018

Languages necessary to complete the course:
Slovak in combination with English (suggested readings in English)

Notes:

Past grade distribution
Total number of evaluated students: 2

ABS	NEABS
100,0	0,0

Lecturers: prof. RNDr. Zdenko Machala, DrSc.

Last change: 01.09.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-710/22	Co-Investigator of the Scientific Project

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

Number of credits: 5

Recommended semester:

Educational level: III.

Prerequisites:

Course requirements:
Active student participation.

Learning outcomes:
The student will acquire practical experience with the design, preparation and conducting of a scientific project.

Class syllabus:
Participation in the preparation of a scientific project. Participation in project research tasks. Assistance in preparing the annual/final project report.

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: 05.09.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-211/22	Completion of PhD Research Project Stage (1)

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:
The course will be classified under the assumption that the PhD student will actively participate in conducting the tasks of the project, he/she will fulfil the assigned tasks and successfully complete the entrusted stage of research work. Completion of the stage will be confirmed by preparing a written scientific report of the results obtained.
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
The PhD student will develop the ability of independent and teamwork in conducting specific scientific-research problems related to the research project, e.g. solving the assigned tasks of the project, planning and implementation of experiments, written processing of results in the form of a report, their publication in journals, and presentation at scientific conferences or seminars.

Class syllabus:
Active participation in conducting research project tasks. Independent scientific activity and fulfilment of assigned tasks. Successful completion of a selected stage of research work. Elaboration of a written scientific report from the obtained results.

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 9

ABS	NEABS
100,0	0,0

Lecturers:

Last change: 01.09.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-212/22	Completion of PhD Research Project Stage (2)

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:
The course will be classified under the assumption that the PhD student will actively participate in conducting the tasks of the project, he/she will fulfil the assigned tasks and successfully complete the entrusted stage of research work. Completion of the stage will be confirmed by preparing a written scientific report of the results obtained.
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
The PhD student will develop the ability of independent and teamwork in conducting specific scientific-research problems related to the research project, e.g. solving the assigned tasks of the project, planning and implementation of experiments, written processing of results in the form of a report, their publication in journals, and presentation at scientific conferences or seminars.

Class syllabus:
Active participation in conducting research project tasks. Independent scientific activity and fulfilment of assigned tasks. Successful completion of a selected stage of research work. Elaboration of a written scientific report from the obtained results.

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: 01.09.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-213/22	Completion of PhD Research Project Stage (3)

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:
The course will be classified under the assumption that the PhD student will actively participate in conducting the tasks of the project, he/she will fulfil the assigned tasks and successfully complete the entrusted stage of research work. Completion of the stage will be confirmed by preparing a written scientific report of the results obtained.
Scale of assessment (preliminary/final): 100/0

Learning outcomes:
The PhD student will develop the ability of independent and teamwork in conducting specific scientific-research problems related to the research project, e.g. solving the assigned tasks of the project, planning and implementation of experiments, written processing of results in the form of a report, their publication in journals, and presentation at scientific conferences or seminars.

Class syllabus:
Active participation in conducting research project tasks. Independent scientific activity and fulfilment of assigned tasks. Successful completion of a selected stage of research work. Elaboration of a written scientific report from the obtained results.

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: 01.09.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

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: 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. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

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: 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. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-806/22	Creation of Teaching Texts and Aids

Educational activities:
Type of activities: independent work
Number of hours:
per week: 5 **per level/semester:** 65
Form of the course: on-site learning

Number of credits: 5

Recommended semester:

Educational level: III.

Prerequisites:

Course requirements:

Learning outcomes:
Creation of a teaching aids or texts as specified.

Class syllabus:
Active participation in the creation of teaching aids and texts.

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: 05.09.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-111/22	Department seminar (1)

Educational activities:
Type of activities: seminar
Number of hours:
per week: 1 **per level/semester:** 13
Form of the course: on-site learning

Type, volume, methods and workload of the student - additional information
1 hour of seminar every two weeks.

Number of credits: 5

Recommended semester: 2.

Educational level: III.

Prerequisites:

Course requirements:
Active presence of the doctoral student at minimum 60% seminars. Student's presentation.

Learning outcomes:
By actively participating at the professional department (division) seminar, the student will gain a broader overview of professional issues and learn how to present own scientific results.

Class syllabus:
Active presence at the department seminar. Students' own professional and scientific work and publication of partial results of their scientific work. Preparation of the materials for the department (division) seminar.

Recommended literature:
Selection of actual literature from relevant topics; Björn Gustavii How to prepare a scientific doctoral dissertation based on research articles, Cambridge University Press, 2012, ISBN: 9781107669048; Björn Gustavii, How to write and illustrate a scientific paper, 3rd Edition, Cambridge University Press, 2017, ISBN: 9781107154056; Barbara Gastel, Robert A. Day, How to write and publish a scientific paper, 8th Edition, Camridge University Press, 2017, ISBN: 9781316640432.

Languages necessary to complete the course:
Slovak, English (literature mostly in English).

Notes:

Past grade distribution
Total number of evaluated students: 11

ABS	NEABS
100,0	0,0

Lecturers: prof. RNDr. Tibor Hianik, DrSc.

Last change: 01.09.2022
Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-112/22	Department seminar (2)

Educational activities:
Type of activities: seminar
Number of hours:
per week: 1 **per level/semester:** 13
Form of the course: on-site learning

Type, volume, methods and workload of the student - additional information
1 hour of seminar every two weeks

Number of credits: 5

Recommended semester: 4.

Educational level: III.

Prerequisites:

Course requirements:
Active presence of the doctoral student at minimum 60% seminars. Student's presentation.

Learning outcomes:
By actively participating at the professional department (division) seminar, the student will gain a broader overview of professional issues and learn how to present own scientific results.

Class syllabus:
Active presence at the department seminar. Students' own professional and scientific work and publication of partial results of their scientific work. Preparation of the materials for the department (division) seminar.

Recommended literature:
Selection of actual literature from relevant topics; Björn Gustavii How to prepare a scientific doctoral dissertation based on research articles, Cambridge University Press, 2012, ISBN: 9781107669048; Björn Gustavii, How to write and illustrate a scientific paper, 3rd Edition, Cambridge University Press, 2017, ISBN: 9781107154056; Barbara Gastel, Robert A. Day, How to write and publish a scientific paper, 8th Edition, Camridge University Press, 2017, ISBN: 9781316640432.

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 9

ABS	NEABS
100,0	0,0

Lecturers: prof. RNDr. Tibor Hianik, DrSc.

Last change: 31.08.2022
Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-113/22	Department seminar (3)

Educational activities:
Type of activities: seminar
Number of hours:
per week: 1 **per level/semester:** 13
Form of the course: on-site learning

Type, volume, methods and workload of the student - additional information
1 hour of seminar every two weeks

Number of credits: 5

Recommended semester: 6.

Educational level: III.

Prerequisites:

Course requirements:
Active presence of the doctoral student at minimum 60% seminars. Student's presentation.

Learning outcomes:
By actively participating at the professional department (division) seminar, the student will gain a broader overview of professional issues and learn how to present own scientific results.

Class syllabus:
Active presence at the department seminar. Students' own professional and scientific work and publication of partial results of their scientific work. Preparation of the materials for the department (division) seminar.

Recommended literature:
Selection of actual literature from relevant topics; Björn Gustavii How to prepare a scientific doctoral dissertation based on research articles, Cambridge University Press, 2012, ISBN: 9781107669048; Björn Gustavii, How to write and illustrate a scientific paper, 3rd Edition, Cambridge University Press, 2017, ISBN: 9781107154056; Barbara Gastel, Robert A. Day, How to write and publish a scientific paper, 8th Edition, Camridge University Press, 2017, ISBN: 9781316640432.

Languages necessary to complete the course:
Slovak, English (literature mostly in English).

Notes:

Past grade distribution
Total number of evaluated students: 10

ABS	NEABS
100,0	0,0

Lecturers: prof. RNDr. Tibor Hianik, DrSc.

Last change: 31.08.2022
Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-114/22	Department seminar (4)

Educational activities:
Type of activities: seminar
Number of hours:
per week: 1 **per level/semester:** 13
Form of the course: on-site learning

Type, volume, methods and workload of the student - additional information
1 hour of seminar every two weeks

Number of credits: 5

Recommended semester: 8.

Educational level: III.

Prerequisites:

Course requirements:
Active presence of the doctoral student at minimum 60% seminars. Student's presentation.

Learning outcomes:
By actively participating at the professional department (division) seminar, the student will gain a broader overview of professional issues and learn how to present own scientific results.

Class syllabus:
Active presence at the department seminar. Students' own professional and scientific work and publication of partial results of their scientific work. Preparation of the materials for the department (division) seminar.

Recommended literature:
Selection of actual literature from relevant topics; Björn Gustavii How to prepare a scientific doctoral dissertation based on research articles, Cambridge University Press, 2012, ISBN: 9781107669048; Björn Gustavii, How to write and illustrate a scientific paper, 3rd Edition, Cambridge University Press, 2017, ISBN: 9781107154056; Barbara Gastel, Robert A. Day, How to write and publish a scientific paper, 8th Edition, Camridge University Press, 2017, ISBN: 9781316640432.

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 8

ABS	NEABS
100,0	0,0

Lecturers: prof. RNDr. Tibor Hianik, DrSc.

Last change: 31.08.2022
Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-709/22	Development of Novel Software Product Linked with PhD Project

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

Number of credits: 5

Recommended semester:

Educational level: III.

Prerequisites:

Course requirements:
The subject will be classified based on practical verification of software functionality.

Learning outcomes:
Development of novel software linked to the dissertation and its creative application in solving dissertation tasks.

Class syllabus:
Development of software related to the dissertation (PhD thesis) and its practical verification. Gaining experience in the development of software for controlling experimental devices or for solving tasks related to the dissertation in a programming language.

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: 05.09.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-801/22	Direct Pedagogical Activity (1)

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:
Minimum 2 hours of pedagogical activities per week.

Learning outcomes:
The student will gain an experience with direct pedagogical activities in conducting of computational exercises or laboratory practices.

Class syllabus:
Regular weekly teaching of students. Conducting computational exercises or laboratory practices. Consultations with the lecturer. Evaluation and correction of tests and papers. Assistance to the lecturer in arranging the exam.

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 22

ABS	NEABS
100,0	0,0

Lecturers:

Last change: 05.09.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-802/22	Direct Pedagogical Activity (2)

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:
Minimum 2 hours of pedagogical activities per week.

Learning outcomes:
The student will gain an experience with direct pedagogical activities in conducting of computational exercises or laboratory practices.

Class syllabus:
Regular weekly teaching of students. Conducting computational exercises or laboratory practices. Consultations with the lecturer. Evaluation and correction of tests and papers. Assistance to the lecturer in arranging the exam.

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: 05.09.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.

STATE EXAM DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-990/15	Dissertation Thesis Defense

Number of credits: 30

Educational level: III.

Recommended prerequisites:
Compulsory and other compulsory optional subjects according to the accreditation file and the individual study plan of the doctoral student. Submission of a written dissertation thesis. At least two (out of three) positive reviewers' reports on the dissertation thesis.

Course requirements:
Examination: oraal:
The evaluation of the subject takes place within the state examination in accordance with the Study Regulations of Faculty of Mathematics, Physics and Informatics in Bratislava and after the submission of the dissertation thesis (as final thesis). The assessment is standard and reflects the sufficient orientation of the student in the topics.

Learning outcomes:
The aim of the course is to make use of theoretical, methodological and applied knowledge of doctoral studies in the elaboration and subsequent defense of the dissertation thesis and thus the successful completion of doctoral studies.

Class syllabus:
With the dissertation, the student demonstrates the ability and readiness for independent scientific and creative activity in the field of research or development. It should be characterized by a high degree of analysis and synthesis of knowledge, as well as a sufficient overview of the existing literature. The work must be original, created by the author in compliance with the rules of working with information sources. The thesis must not have the character of plagiarism, it must not infringe the copyrights of other authors. The author is obliged to consistently cite the information sources used, to name the specific results of research of other authors by citing the relevant source, to accurately describe the methods and working procedures used by other authors, to document the laboratory results of other authors. The citation technique is guided by the practice in the given scientific field, respecting the relevant norms and standards. The composition of the examination committee, assignment of the reviewers and the course of the dissertation examination are governed by the current Study Regulations of Faculty of Mathematics, Physics and Informatics.

State exam syllabus:

Recommended literature:
Ako písať vysokoškolské a kvalifikačné práce : Ako písať seminárne práce, ročníkové práce, práce študentskej vedeckej a odbornej činnosti, diplomové práce, záverečné a atestačné práce, dizertácie / Dušan Katuščák. Bratislava : Stimul, 1998

Last change: 01.09.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-312/22	Domestic Journal – Current Content/Registered in WoS Database

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:
The course will be classified under the assumption that the PhD student will be able to successfully publish a manuscript in a domestic journal – current content or registered in Web of Science database. The number of credits (30) is the maximum available, that can be reduced by the supervisor after taking into account the partial share of the student in the preparation of the paper.

Learning outcomes:
The PhD student will gain practical experience with processing the results for publication, preparation and writing of the manuscript, sending it to journal and responding to reviewer's comments.

Class syllabus:
Processing of results and their preparation for publication. Manuscript preparation. Submitting a manuscript to the editor. Answering comments of reviewers. Proofs reading. Communication with the journal editor.

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: 05.09.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-314/22	Domestic Journal – Non-Current Content/Non-Registered in WoS Database

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

Number of credits: 15

Recommended semester:

Educational level: III.

Prerequisites:

Course requirements:
The course will be classified under the assumption that the PhD student will be able to successfully publish a manuscript in a domestic journal – non-current content or non-registered in Web of Science database. The number of credits (15) is the maximum available, that can be reduced by the supervisor after taking into account the partial share of the student in the preparation of the paper.

Learning outcomes:
The PhD student will gain practical experience with processing the results for publication, preparation and writing of the manuscript, sending it to journal and responding to reviewer's comments.

Class syllabus:
Processing of results and their preparation for publication. Manuscript preparation. Submitting a manuscript to the editor. Answering comments of reviewers. Proofs reading. Communication with the journal editor.

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 1

ABS	NEABS
100,0	0,0

Lecturers:

Last change: 05.09.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-004/22	Effect of Light on Living Organisms

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

Number of credits: 10

Recommended semester: 1.

Educational level: III.

Prerequisites:

Course requirements:
The evaluation of the course will be in the form of a continuous (individual work) and final evaluation (oral exam). Successful completion of the course reflects sufficient orientation of the student in the issue. The course will be classified as a graduate provided that the doctoral student proves the fulfilment of obligations at the level of at least 51%. The conditions for successful completion of the course are in accordance with the Study Regulations of the Faculty of Mathematics, Physics and Informatics.

Learning outcomes:
Gaining knowledge about the mechanisms of light radiation on a living organism, its consequences and possibilities of medical use.

Class syllabus:
Solar radiation and artificial light sources. Reflection, scattering and absorption of light radiation by components of living organisms. Intrinsic chromophores and fluorophores. Phototherapy, Photodynamic therapy, Photodiagnostics. Laser safety.

Recommended literature:
Hollas J.M.: Modern Spectroscopy, Wiley, New York, 2004
Kraayenhof R.: Fluorescence Spectroscopy, Imaging and Probes, Springer, Berlin, 2002
Niemz M.H.: Laser-Tissue Interactions. Fundamentals and applications. Springer, Berlin, 2004
Cember H., Johnson T.E.: Introduction to Health Physics. Mc Graw Hill, NY, 2009
Health Effects of Artificial Light, Scientific Committee on Emerging and Newly Identified Health Risks, http://ec.europa.eu/health/scientific_committees/policy/index_en.htm, 2021
C.A. Robertsonet al.: Photodynamic therapy (PDT): A short review on cellular mechanisms and cancer research applications for PDT. Journal of Photochemistry and Photobiology B: Biology 96 (2009) 1–8
Sarici S.U.et al.:Fiberoptic phototherapy versus conventional daylight phototherapy for hyperbilirubinemia of term newborns. Turkish Journal of pediatrics 43 (2021) 280-285.

Hooper, M; Hatch, L and Seminario-Vidal, L.:Photodynamic therapy of mycosis fungoides: A systematic review of case studies. Photodermatology photoimmunology&photomedicine. May 2021 (Early Access).
Probes, Springer, Berlin, 2002
UV-VIS Spectroscopy and its Applications, Springer, Berlin, 1992

Languages necessary to complete the course:
Slovak in combination with English (suggested readings in English)

Notes:

Past grade distribution
Total number of evaluated students: 11

ABS	NEABS
100,0	0,0

Lecturers: prof. RNDr. Libuša Šikurová, CSc.

Last change: 01.09.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KAFZM/3-FEM-018/22	Environmental Biophysics

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

Number of credits: 10

Recommended semester: 4.

Educational level: III.

Prerequisites:

Course requirements:
The evaluation of the course will be in the form of a continuous (test) and final evaluation (oral exam). Successful completion of the course reflects sufficient orientation of the student in the issue. The course will be classified as a graduate provided that the doctoral student proves the fulfilment of obligations at the level of at least 51%. The conditions for successful completion of the course are in accordance with the Study Regulations of the Faculty of Mathematics, Physics and Informatics.

Learning outcomes:
To acquaint doctoral students with the biological aspects of environmental physics.

Class syllabus:
1. Physical factors of the external environment. Interaction of a living system with environmental factors. 2. The effect of mechanical factors on the organism. Influence of gravity and weightless state. Positive and negative acceleration. Kinetosis. Harmful effects of mechanical energy: shocks and vibrations. Influence of vacuum (hypobaria) and hypoxia. Influence of overpressure (hyperbaria). Henry's law and decompression sickness. Disbarism and barotrauma. 3. Effect of acoustic factors. Sound and ultrasonic fields. Noise and acoustic bang. Hearing disorders. Biophysics of ultrasound. Ultrasound generators. Properties and biological effects of ultrasound. Application of ultrasound in therapy. Properties and biological effects of infrasound. 4. Influence of meteorological conditions. Effects of thermal energy and humidity. Heat exchange between the organism and the environment. Thermoregulatory mechanisms in the living system. Influence of heat, cold, humidity on thermoregulation. Electroclimate. Influence of positive and negative ions of spatial charge. 5. Influence of electric field. Conduction of electric current through tissues. The effect of direct current. Electrophoresis and electroosmosis. Effect of low and high frequency alternating currents. Electrical tissue irritation. Electronic stimulators and high-frequency microthermotherapy. 6. Influence of magnetic fields. Static, variable and pulsed magnetic fields. Magnetic fields homogeneous and inhomogeneous. 7. Influence of ionizing radiation. Effects of visible light. Solar dermatitis. Properties and thermal effects of IR radiation. Biochemical and biological effects of UV radiation. 8. Influence of ionizing radiation. Direct and indirect effect. Levels of the body's response to radiation and forms of damage to the body. Primary and secondary cosmic rays. Analysis of effects on living systems.

Recommended literature:
Rádionuklidová röntgenofluorescenčná analýza zložiek životného prostredia / Juraj Tölgyessy, Emil Havránek, Eva Dejmková. Bratislava : Alfa, 1983;
G.S. Campbell: An Introduction to Environmental Biophysics, Springer Verlag, New York 2010

Languages necessary to complete the course:
Slovak in combination with English (suggested readings in English)

Notes:

Past grade distribution
Total number of evaluated students: 2

ABS	NEABS
100,0	0,0

Lecturers: prof. RNDr. Melánia Babincová, DrSc.

Last change: 24.03.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-003/22	Experimental Methods of Biophysics

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

Number of credits: 10

Recommended semester: 1.

Educational level: III.

Prerequisites:

Course requirements:
The evaluation of the course will be in the form of a continuous (individual work) and final evaluation (oral exam). Successful completion of the course reflects sufficient orientation of the student in the issue. The course will be classified as a graduate provided that the doctoral student proves the fulfilment of obligations at the level of at least 51%. The conditions for successful completion of the course are in accordance with the Study Regulations of the Faculty of Mathematics, Physics and Informatics.
Scale of assessment (preliminary/final): 50/50

Learning outcomes:
To acquaint doctoral students with selected frequently used methods for determining the structure and properties of biological objects so that they understand the methodological procedure in the scientific literature and are able to independently choose a suitable method for solving a biophysical problem.

Class syllabus:
Scattering and diffraction of X-ray, electrons and neutrons (Symmetry of crystals, cylindrical and helical objects, symmetry of viruses. Determination of the structure of crystals, problem of phase. Determination of the structure of amorphous substances and partially oriented systems. Preparation of samples for measurement. Experimental set up, available sources of synchrotron and neutron radiation)
Magnetic resonance methods (Magnetic resonance in a condensed matter. Nuclear magnetic resonance, electron paramagnetic resonance. Continual and pulse methods. Multiple resonance methods. Spectral methods, imagine methods and their combination. Preparation of samples and living objects for measurement. Experimental techniques, availability of experimental instruments).
Electron microscopy (Transmission and raster microscopy, electron optics. Preparation of samples for measurements. Reconstruction of the structure from micrographs. Experimental technique)
Ion microscopy. Light microscopy. (Transmission and reflection microscopy, in monochromatic, UV and IR light. Fluorescence, polarized and interference microscopy. Spatial reconstruction, stereology and analysis of imagine. Cytophotometry, historadiography and autoradiography).

Optical spectroscopy (Light sources, spectral analysis, detectors of optical radiation. Absorption spectroscopy and Raman spectroscopy. Chiotropic methods. Emission spectroscopy)
Light scattering (Statics and dynamics light scattering and its application for determination of the shape of biological objects)
Preparative and analytical methods (Extraction, aggregation, sedimentation, membrane mehods, chromatographic methods, electrophoresis, crystallization, liophilization, solubilization. Determination pf molecular weight.

Recommended literature:

Introduction to experimental biophysics : Biological methods for physical scientists / Jay Nadeau. Boca Raton : CRC Press, 2012
Methods in molecular biophysics : Structure, dynamics, function / Igor N. Serdyuk, Nathan R. Zaccai, Joseph Zaccai. Cambridge : Cambridge University Press, 2007
Original and review articles from scientific journal of biophysical orientation according to selection of lecturer and according to actual interest of the students.

Languages necessary to complete the course:
Slovak in combination with English (suggested readings in English)

Notes:

Past grade distribution
Total number of evaluated students: 7

ABS	NEABS
100,0	0,0

Lecturers: prof. RNDr. Daniela Uhríková, CSc.

Last change: 01.09.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-101/22	Individual Study of Science and Research Resources (2)

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: 2.

Educational level: III.

Prerequisites:

Course requirements:
The evaluation of the subject is individual by the supervisor, according to the individual study plan of the doctoral student. The evaluation reflects the sufficient orientation of the student in the subject. The conditions for successful completion of the course are in accordance with the Study Regulations of Faculty of Mathematics, Physics and Informatics.

Learning outcomes:
Learn to work with SCOPUS and Web of Science databases. Search for publications related to the topic of the dissertation and be able to critically assess the content of these works and process their substantial results.

Class syllabus:
Literature search in SCOPUS and Web of Science databases by keywords and other options. Search for new published works related to the topic of the dissertation. Obtain important publications in electronic form from databases and directly from authors. Learn to critically assess the content of the articles read and process their essential results. Assessment of the obtained literature search by the supervisor.
The subject is important especially for understanding the basic theoretical and methodological aspects of the topic of the dissertation with emphasis on self-study. It contributes to the professional potential of the doctoral student in the next (scientific) stage of his/her studies.

Recommended literature:
Determined by the supervisor with respect to the topic. The recommended literature is part of the doctoral student's individual study plan.

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: 01.09.2022	
Approved by: prof. RNDr. Melánia Babincová, DrSc.	

COURSE DESCRIPTION

Academic year: 2025/2026	
University: Comenius University Bratislava	
Faculty: Faculty of Mathematics, Physics and Informatics	
Course ID: FMFI.KJFB/3-FBF-104/22	**Course title:** Individual Study of Science and Research Resources (2)
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: 4.	
Educational level: III.	
Prerequisites:	
Course requirements: The evaluation of the subject is individual by the supervisor, according to the individual study plan of the doctoral student. The evaluation reflects the sufficient orientation of the student in the subject. The conditions for successful completion of the course are in accordance with the Study Regulations of Faculty of Mathematics, Physics and Informatics.	
Learning outcomes: Learn to work with SCOPUS and Web of Science databases. Search for publications related to the topic of the dissertation and be able to critically assess the content of these works and process their substantial results.	
Class syllabus: Literature search in SCOPUS and Web of Science databases by keywords and other options. Search for new published works related to the topic of the dissertation. Obtain important publications in electronic form from databases and directly from authors. Learn to critically assess the content of the articles read and process their essential results. Assessment of the obtained literature search by the supervisor. The subject is important especially for understanding the basic theoretical and methodological aspects of the topic of the dissertation with emphasis on self-study. It contributes to the professional potential of the doctoral student in the next (scientific) stage of his/her studies.	
Recommended literature: Determined by the supervisor with respect to the topic. The recommended literature is part of the doctoral student's individual study plan.	
Languages necessary to complete the course: Slovak, English (literature mostly in English)	
Notes:	

Past grade distribution Total number of evaluated students: 16	
ABS	NEABS
100,0	0,0
Lecturers:	
Last change: 01.09.2022	
Approved by: prof. RNDr. Melánia Babincová, DrSc.	

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-311/22	International Journal – Current Content/Registered in WoS database

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:
The course will be classified under the assumption that the PhD student will be able to successfully publish a manuscript in a current content international journal or registered in Web of Science database. The number of credits (35) is the maximum available, that can be reduced by the supervisor after taking into account the partial share of the student in the preparation of the paper.

Learning outcomes:
The PhD student will gain practical experience with processing the results for publication, preparation and writing of the manuscript, sending it to journal and responding to reviewer's comments.

Class syllabus:
Processing of results and their preparation for publication. Manuscript preparation. Submitting a manuscript to the editor. Answering comments of reviewers. Proofs reading. Communication with the journal editor.

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 10

ABS	NEABS
100,0	0,0

Lecturers:

Last change: 05.09.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-313/22	International Journal – Non-Current Content/Non-Registered in WoS database

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:
The course will be classified under the assumption that the PhD student will be able to successfully publish a manuscript in an international journal – non-current content or non-registered in Web of Science database. The number of credits (20) is the maximum available, that can be reduced by the supervisor after taking into account the partial share of the student in the preparation of the paper.

Learning outcomes:
The doctoral student will gain practical experience with processing the results for publication, preparation and writing of the manuscript, sending it to journal and responding to reviewer's comments.

Class syllabus:
Processing of results and their preparation for publication. Manuscript preparation. Submitting a manuscript to the editor. Answering comments of reviewers. Proofs reading. Communication with the journal editor.

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 1

ABS	NEABS
100,0	0,0

Lecturers:

Last change: 05.09.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-708/22	Introduction of Novel Experimental Method Linked with PhD Project

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

Number of credits: 5

Recommended semester:

Educational level: III.

Prerequisites:

Course requirements:
The subject will be classified based on practical verification of novel experimental method functionality.

Learning outcomes:
Development of novel experimental method linked to the PhD thesis and its creative application in solving dissertation tasks.

Class syllabus:
Design and practical implementation of a new experimental methodology related to the topic of the dissertation, or with the topic used in practices at the department or the research group.

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: 05.09.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-012/22	Methods for Preparation and Implementation of Research Projects

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

Number of credits: 10

Recommended semester: 2.

Educational level: III.

Prerequisites:

Recommended prerequisites:
-

Antirequisites: FMFI.KJFB/3-FBF-012/11

Course requirements:
Activity during sessions, homework
Exam: course term work
Scale of assessment (preliminary/final): 50/50
Scale of assessment (preliminary/final): 50/50

Learning outcomes:
The doctoral student acquires and develops competencies related to the methodology of scientific research, and he/she is able to apply the principles in the project outline, as well as to prepare and submit the research project proposal. In addition, the doctoral student will be able to critically appraise scientific papers from a methodological point of view.

Class syllabus:
Research project, the project plan: budget, time frame, endpoints, quality and risk assessments, benefits. Writing a project proposal, submission, legal and ethical aspects of biomedical research, project administration. Data collection, sorting and cleaning. Experimental designs: single-factor, completely randomized and randomized blocks design, grid, factorial, hierarchical designs. Fixed vs. random effects, main and simple main effects. Fitting models to biophysical and biomedical data. Interpretation of analytical outputs with respect to the methods and design used. Presentation and publication of project outputs. Project reporting: content and financial parts.

Recommended literature:
Waczulíková, I., Slezák, P. (2015). Introductory Biostatistics. Bratislava: Comenius University, 1 st Edition, 2015, 147 p. ISBN 978-80-223-3938-4.
Wiliam. G. Cochran and Gertrude M. Cox. Experimental Designs, John Wiley &Sons, inc. 2nd Edition 1992. 611 p. ISBN 0-471-54567-8.

Katz, M. H. (2006). Study design and statistical analysis: A practical guide for clinicians. Cambridge, UK: Cambridge University Press. 188 p. ISBN 978-0-521-53407-9
Bland, M., & Peacock, J. (2003). Statistical Questions in Evidence-based Medicine. Oxford Univeristy Press. 253 p. ISBN 978-0-19-262992-0
Kumar, Malhar N. A Review of the Types of Scientific Misconduct in Biomedical Research. (2008). J Acad Ethics 6:211–228, DOI 10.1007/s10805-008-9068-6
Legislation and documents of World Medical Association Declaration of Helsinki, ethical principles for medical research involving human subjects

Languages necessary to complete the course:
Slovak, English (literature mostly in English).

Notes:
-

Past grade distribution
Total number of evaluated students: 13

ABS	NEABS
100,0	0,0

Lecturers: prof. RNDr. Iveta Waczulíková, PhD.

Last change: 02.06.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-001/22	Molecular Biophysics

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

Type, volume, methods and workload of the student - additional information
2 hours of lectures per week, presence method

Number of credits: 10

Recommended semester: 2.

Educational level: III.

Prerequisites:

Course requirements:
The evaluation of the course will be in the form of a continuous (individual work) and final evaluation (oral exam). Successful completion of the course reflects sufficient orientation of the student in the issue. The course will be classified as a graduate provided that the doctoral student proves the fulfilment of obligations at the level of at least 51%. The conditions for successful completion of the course are in accordance with the Study Regulations of the Faculty of Mathematics, Physics and Informatics.

Learning outcomes:
By completing the course, the student acquires a knowledge on the mechanisms of processes in the living systems on molecular level.

Class syllabus:
Structure and physical properties of nucleic acids and proteins. The structure and physical properties of biomembranes and their models. Membrane polymorphism. Phase transitions and membrane mechanical properties. The mechanism of membrane conductivity. Passive and active ion transport. Mechanisms of mechanoreception and optical reception. Membrane theory of extication. The mechanisms of origin and propagation of nerve impulse. Hodgkin and Huxley model. The structure of muscle and muscle fibers. Electrochemical coupling of muscle contraction. Theory of muscle contraction.

Recommended literature:
Actual scientific literature according to the recommendation of the lecturer. P.F. Dillon, Biophysics: a physiological approach, Cambridge University Press, 2012; B. Alberts et al., Essential Cell Biology, Fourth Edition, W.W. NORTON & COMPANY, 2019 ISBN 9780393679533

Languages necessary to complete the course:
Slovak in combination with English (suggested readings in English)

Notes:	
Past grade distribution Total number of evaluated students: 14	
ABS	NEABS
100,0	0,0
Lecturers: prof. RNDr. Tibor Hianik, DrSc.	
Last change: 01.09.2022	
Approved by: prof. RNDr. Melánia Babincová, DrSc.	

COURSE DESCRIPTION

Academic year: 2025/2026	
University: Comenius University Bratislava	
Faculty: Faculty of Mathematics, Physics and Informatics	
Course ID: FMFI.KJFB/3-FBF-007/22	**Course title:** Molecular Dynamics of Biological Systems
Educational activities: **Type of activities:** lecture **Number of hours:** **per week:** 3 **per level/semester:** 39 **Form of the course:** on-site learning	
Number of credits: 10	
Recommended semester: 2.	
Educational level: III.	
Prerequisites:	
Course requirements: The evaluation of the course will be in the form of a continuous (individual work) and final evaluation (oral exam). Successful completion of the course reflects sufficient orientation of the student in the issue. The course will be classified as a graduate provided that the doctoral student proves the fulfilment of obligations at the level of at least 51%. The conditions for successful completion of the course are in accordance with the Study Regulations of the Faculty of Mathematics, Physics and Informatics. Scale of assessment (preliminary/final): 30/70	
Learning outcomes: To acquaint students with the problems of molecular dynamics (basic principles, calculations of individual physical quantities) with the use of molecular dynamics for the study of interaction mechanisms in biological systems.	
Class syllabus: Molecular dynamics (MD), algorithms and methods in MD, interactions in molecular systems, their calculations, forcefield, analysis of results. Modeling of lipid bilayer, peptides, study of the mechanisms of interactions in lipid bilayer.	
Recommended literature: O. Becker et al. Computational Biochemistry and Biophysics, Dekker, 2000 Methods in molecular biophysics : Structure, dynamics, function / Igor N. Serdyuk, Nathan R. Zaccai, Joseph Zaccai. Cambridge : Cambridge University Press, 2007	
Languages necessary to complete the course: Slovak in combination with English (suggested readings in English)	
Notes:	

Past grade distribution Total number of evaluated students: 7	
ABS	NEABS
100,0	0,0
Lecturers: prof. RNDr. Peter Babinec, CSc., RNDr. Ing. Milan Melicherčík, PhD., Mgr. Ivan Sukuba, PhD.	
Last change: 01.09.2022	
Approved by: prof. RNDr. Melánia Babincová, DrSc.	

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-701/22	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: 15

Recommended semester:

Educational level: III.

Prerequisites:

Course requirements:
The course will be classified if the PhD student receives funding support for his/her university grant.

Learning outcomes:
The PhD student will gain practical experience with the preparation of a scientific project / grant, its solution, and writing of a final report.

Class syllabus:
Preparation of a scientific project/grant of Comenius University. Composition of the scientific program of the project, determination of project objectives, work progress, and project budget. Project solution. Preparation of the final report of the project.

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 13

ABS	NEABS
100,0	0,0

Lecturers:

Last change: 05.09.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.

STATE EXAM DESCRIPTION

Academic year: 2025/2026	
University: Comenius University Bratislava	
Faculty: Faculty of Mathematics, Physics and Informatics	
Course ID: FMFI.KJFB/3-FBF-950/15	**Course title:** Passing Dissertation Examination
Number of credits: 20	
Educational level: III.	
Recommended prerequisites: Compulsory and other compulsory optional subjects according to the accreditation file and the individual study plan of the doctoral student. Submission of a written work for the dissertation exam with the project of the dissertation. Reviewer's report on the written work for the dissertation exam with the project of the dissertation.	
Course requirements: Examination: oral The evaluation of the subject takes place within the state examination in accordance with the Study Regulations of Faculty of Mathematics, Physics and Informatics in Bratislava and after the submission of the written work for the dissertation examination within the set deadline. The subjects of the state examination include a discussion of the written work for the dissertation examination (prepared by the doctoral student) and other subjects of the oral examination (ad hoc) approved by the dean. The assessment is standard and reflects the sufficient orientation of the student in the topics.	
Learning outcomes: The doctoral student at the dissertation exam will demonstrate his/her ability to continue the PhD studies, present a project of the dissertation, which will be assessed by the committee.	
Class syllabus: In the first part of the exam, presentation of the dissertation project, proposal of the dissertation objectives. In the second part, the student will answer to examination committee three questions from one of the following thematic areas according to the focus of his dissertation regarding the individually studied literature and the recommendation of the supervisor	
State exam syllabus:	
Last change: 01.09.2022	
Approved by: prof. RNDr. Melánia Babincová, DrSc.	

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-401/22	Presentation at International Conference

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:
The course will be classified if the PhD student will personally present the results of their work in the form of an oral presentation or a poster at an international conference in English. The conference is not considered international if the official language is Slovak or Czech (or other local language).

Learning outcomes:
The PhD student will gain experience in preparing a presentation and presenting the results of his/her scientific work to a foreign scientific audience.

Class syllabus:
Processing of experimental results. Preparation of the contribution (abstract) in the conference proceedings and of the presentation. Presentation at international conference. Answering questions from the audience.

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 28

ABS	NEABS
100,0	0,0

Lecturers:

Last change: 05.09.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-403/22	Presentation at a Home Conference

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

Number of credits: 15

Recommended semester:

Educational level: III.

Prerequisites:

Course requirements:
The course will be classified if the PhD student will personally present the results of their work in the form of an oral presentation or a poster at a domestic conference in Slovak language. The conference is considered domestic if the official language is Slovak or Czech.

Learning outcomes:
The PhD student will gain experience in preparing a presentation and presenting the results of his/her scientific work to a scientific audience.

Class syllabus:
Processing of experimental results. Preparation of the contribution (abstract) in the conference proceedings and of the presentation. Presentation at domestic conference. Answering questions from the audience.

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: 05.09.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-005/22	Selected Chapters from Human Biomechanics

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

Number of credits: 10

Recommended semester: 1.

Educational level: III.

Prerequisites:

Course requirements:
The evaluation of the course will be in the form of a continuous (individual work) and final evaluation (oral exam). Successful completion of the course reflects sufficient orientation of the student in the issue. The course will be classified as a graduate provided that the doctoral student proves the fulfilment of obligations at the level of at least 51%. The conditions for successful completion of the course are in accordance with the Study Regulations of the Faculty of Mathematics, Physics and Informatics.
Scale of assessment (preliminary/final): 30/70

Learning outcomes:
To acquaint doctoral students with human biomechanics and its applications in biology and medicine.

Class syllabus:
Biomechanics of the musculoskeletal system and movement analysis. Segmental structure of the human body, center of gravity, mass and moment of inertia of the body and its segments. Mechanical properties of solid biomaterials - cartilage and bone. Biomechanics of blood circulation. Elastic properties of blood vessels and hydrodynamics of blood flow in blood vessels. Respiratory system mechanics. Origin and characteristics of the human voice. Digestive system biomechanics. Chewing pressure transmission mechanics. Nerve tissue biomechanics. Biomechanics of hearing. Effects of mechanical forces on the human body. Application of biomechanics in biology. Applications of biomechanics in medicine - therapy and diagnostics. Biomechanical properties of substitutes for substitution therapy

Recommended literature:
Vogel J. Biomechanics, Princeton, University Press, 2003.
Valenta J. Biomechanics, Academia and Kluwer Academic Publishers, 2002.
http://en.wikipedia.org/wiki/Biomechanics

Languages necessary to complete the course:
Slovak in combination with English (suggested readings in English)

Notes:	
Past grade distribution Total number of evaluated students: 9	
ABS	NEABS
100,0	0,0
Lecturers: prof. RNDr. Melánia Babincová, DrSc.	
Last change: 01.09.2022	
Approved by: prof. RNDr. Melánia Babincová, DrSc.	

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-405/22	Study Stay Abroad

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

Number of credits: 5

Recommended semester:

Educational level: III.

Prerequisites:

Course requirements:
Active student participation.

Learning outcomes:
The student will acquire the new knowledge and practical experience with the labour organization in other foreign institutions.

Class syllabus:
Study stay in a research institution abroad approved by the guarantor or the supervisor.

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 13

ABS	NEABS
100,0	0,0

Lecturers:

Last change: 05.09.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-803/22	Supervision of a 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:
By supervising a bachelor thesis, the doctoral student will be involved in scientific and pedagogical activities at the department.

Class syllabus:
Proposing the topic of the bachelor thesis related to the dissertation of the doctoral student. Consultations and supervision of the work of a student training in the laboratory. Elaboration of the supervisor's review on the bachelor thesis.

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: 05.09.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-804/22	Supervision of a Student at the Student Science Conference

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

Number of credits: 5

Recommended semester:

Educational level: III.

Prerequisites:

Course requirements:

Learning outcomes:
Supervision of a bachelor/master student during the Student Science Conference (extracurricular activity of a university student).

Class syllabus:
Critical reading of the student's paper for the Student Science Conference. Assessment of the paper from a professional and formal point of view.

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: 05.09.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-002/22	Theoretical Methods of the Study the Molecular Systems

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

Number of credits: 10

Recommended semester: 1.

Educational level: III.

Prerequisites:

Course requirements:
The evaluation of the course will be in the form of a continuous (individual work) and final evaluation (oral exam). Successful completion of the course reflects sufficient orientation of the student in the issue. The course will be classified as a graduate provided that the doctoral student proves the fulfilment of obligations at the level of at least 51%. The conditions for successful completion of the course are in accordance with the Study Regulations of the Faculty of Mathematics, Physics and Informatics.
Scale of assessment (preliminary/final): 30/70

Learning outcomes:
To provide the graduate with an overview of available theoretical methods used to research the structure and dynamic properties of particularly biologically interesting molecules. The acquired knowledge will help to critically evaluate the applicability and relevance of the theoretical methods used in the literature.

Class syllabus:
The study of statical properties:
Quantum mechanic description of energetic and reactivity of molecules (HF, post HF and DFT methods, semi empirical methods, methods of molecular mechanics, combined methods).
Study of dynamical properties:
Methods of molecular dynamics, Monte Carlo methods, analysis of the results of simulations, methods of classical and quasi classical trajectories.

Recommended literature:
O.Becker et al. Computational Biochemistry and Biophysics, Dekker, 2000
A. Szabo N. S. Ostlund: Modern Quantum Chemistry: Introduction to Advanced Electronic Structure Theory
P.W. Atkins: Molecular Quantum Mechanics, Oxford Univ. Press, 1970

Languages necessary to complete the course:

Notes:

Past grade distribution Total number of evaluated students: 7	
ABS	NEABS
100,0	0,0
Lecturers: prof. Ing. Pavel Mach, CSc.	
Last change: 01.09.2022	
Approved by: prof. RNDr. Melánia Babincová, DrSc.	

COURSE DESCRIPTION

Academic year: 2025/2026

University: Comenius University Bratislava

Faculty: Faculty of Mathematics, Physics and Informatics

Course ID:	**Course title:**
FMFI.KJFB/3-FBF-808/22	Writing Final Thesis Assessment Protocol

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

Number of credits: 5

Recommended semester:

Educational level: III.

Prerequisites:

Course requirements:

Learning outcomes:
Preparation of an assessment for the final thesis of a student of a bachelor's (master's) degree.

Class syllabus:
Critical reading of the final thesis of a student of a bachelor's (master's) degree. Assessment work from both a professional and a formal point of view. Reproach for shortcomings. Evaluation of work with a mark.
Preparation of an assessment and participation in the defense of work.

Recommended literature:

Languages necessary to complete the course:

Notes:

Past grade distribution
Total number of evaluated students: 1

ABS	NEABS
100,0	0,0

Lecturers:

Last change: 05.09.2022

Approved by: prof. RNDr. Melánia Babincová, DrSc.