gList of subject information sheets for the Bachelor's degree programme in Biotechnology

List of subject

Compulsory subjects:

1. Advanced Biology for Biotechnologists
2. **Agricultural Biotechnology**
3. **Bachelor Project**
4. **Balance Systems in Biotechnological Processes**
5. **Basic Biology for Biotechnologists**
6. Biochemistry
7. Biophysical Chemistry
8. Calculations Seminar I
9. Calculations Seminar II
10. Computer-aided Molecular Design
11. Environmental Biotechnology
12. **Enzyme Biotechnology**
13. **Enzymology**
14. **Experimental Activities for the Bachelor Thesis**
15. **Fundamentals of Biotechnological Processes and Equipment**
16. Fundamentals of Microbiology
17. General Chemistry
18. Information and Communication Technologies
19. Inorganic Chemistry
20. **Introduction to Biotechnology**
21. Introduction to Physics
22. **Laboratory Exercise in Advanced Biology**
23. Laboratory Exercise in Biochemistry
24. **Laboratory Exercise in Biology**
25. **Laboratory Exercise in Enzymology**
26. Laboratory Exercise in General Chemistry
27. Laboratory Exercise in Inorganic Chemistry
28. Laboratory Exercise in Microbiology
29. Laboratory Exercise in Molecular Biology
30. Laboratory Exercise in Organic Chemistry
31. Laboratory Exercise in Separation Methods
32. **Methods and Techniques of Gene Manipulation**
33. **Microbial Biotechnology**
34. Molecular Biology Databases
35. Organic Chemistry
36. **Principles of Molecular Biology**
37. Professional Communication in English I
38. Professional Communication in English II
39. **Regulation and Biosafety of Biotechnology**
40. Semester Project
41. Separation Methods
42. **Theory and Methodology of the Bachelor Thesis**

*** The profile subjects are marked in bold**

Compulsory optional subjects:

1. Animal Biology
2. Basic Statistics
3. Biophysical Chemistry II
4. Environmental Monitoring and Bioindicators

5. Environmental Toxicology
6. Evolutionary Biology
7. General Virology
8. Genetics
9. Introduction to Radioecology
10. Mathematics
11. Natural Drugs
12. Organic Chemistry II
13. Plant Physiology
14. Professional Communication in English III
15. Professional Communication in English IV
16. Renewable Energy
17. Sustainable Development
18. Waste Management

Optional subjects:

1. Sports Activities I
2. Sports Activities II
3. Sports Activities III
4. Sports Activities IV
5. Sports Activities V
6. Sports Activities VI

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Compulsory courses

University of Ss. Cyril and Methodius in Trnava
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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd308	**Subject name: Advanced Biology for Biotechnologists**
Type, scope, and method of educational activities: Compulsory subject. Profile subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 2 hours of lectures and 2 hours of seminars per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 5	
Recommended semester/trimester of study: semester 2	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: As a part of the continuous assessment, two tests will be written (in the 7th week and in the 12th week of the semester). It is mandatory for the student to obtain at least 50% of the points from each of the tests. The final evaluation of the course is a written exam (3 questions) followed by an oral examination. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: The student: • is able to use the knowledge and terminology of basic biology correctly, which will enable him fast to be oriented in biological and biology related subjects; • to understand the organisation and function of living organisms on different levels; • can logically understand the principles of nature and mechanisms of living systems.	
Brief content of the subject: 1. Formation of nucleic acids and proteins. 2. Patterns of genetic information. 3. Overview of the cellular level of the organization from microorganisms, through viruses, plants, animals to humans. 4. The importance of individual groups of living organisms in the ecosystem from the evolutionary point of view and relational. 5. Principles and ways of transition to the supercell level of the organization of living systems. 6. Multicellular living organisms: advantages and disadvantages of multicellularity. 7. Specialization and morphogenesis: principles, stimuli, methods. 8. Organization of cells into tissues and tissues: histology of plants and animals. 9. Domestication and breeding mechanisms. 10. Relationships between cellular metabolism, extracellular organization and function. 11. Regulation of life processes at the multicellular level. 12. Practical aspects of multicellular organization of living systems.	
Recommended literature: *Urry L., Cain M., Wasserman S., Minorsky P., Orr R.: Campbell Biology. Pearson Education 2021, 1504 pp. ISBN-13: 9780135988046* *Victoria Aspinall, Melanie Cappello: Introduction to Animal and Veterinary Anatomy and Physiology. Bell and Brain Ltd. Glasgow 2019, 160 pp. ISBN-13: 978-1789241150* *Madigan M.T. et al.: Brock Biology of Microorganisms, Global Edition. Pearson Education Limited, 2018, 1064 pp. ISBN: 9781292235103*	

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Neil A. Campbell et al.: Biology. Pearson Education Limited 2020, 1504 s. ISBN-10: 1292341637					
Language, knowledge of which is necessary to complete the subject: English					
Subject evaluation					
A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00
Notes:					
Teacher: Assoc. Prof. RNDr. Michaela Havrlentová, PhD.					
Date of last change: 28.02.2022					
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd325	**Subject name: Agricultural Biotechnology**
Type, scope, and method of educational activities: Compulsory subject. Profile subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 2 hours of lectures per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 3	
Recommended semester/trimester of study: semester 4	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: Successful completion of the oral exam. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: The student: • will gain knowledge and overview of biotechnologies used and applied in agriculture • will know the range of applications of biotechnology in agriculture, especially techniques improving the parameters and properties of plants and animals for agriculture • will understand the principles of biotechnological techniques as well as their application in plants and animals • gain knowledge about plants and animals as producers of food, feed, raw materials, energy, and services. Obtained skills. The student will: • able to design laboratory experiments for the development of biotechnologically modified organisms for agriculture and to apply biotechnological procedures and biotechnologically modified plants and animals. Completion of the course will give the student competence: • work with biotechnologically modified plants and animals in agriculture and also in sectors where biotechnologically modified plants and animals are already used, i.e. not only in agriculture but also in industry and services Graduated student will: • acquire the ability to select and design biotechnological experiments with plants and animals for production processes • be able to consider the prospects of biotechnology inclusion into agriculture, also there where it has not yet been used.	
Brief content of the subject: 1. Genetics and genomics of plants and animals domestication, genetic variation, various methods of breeding in organisms for agriculture 2. Cell and mutation breeding 3. Mapping of genomes and genes, use of genetic maps in molecular breeding 4. Selection by molecular markers (MAS) 5. Techniques of gene transfer into plants 6. Techniques of gene transfer into animals	

7. Transgenic organisms in agriculture - improvement of their parameters and properties by genetic and genomic approach
8. Transgenic organisms in agriculture - phytoremediation, resistance to pathogens and pests
9. Transgenic organisms in agriculture - biotechnological increase in quantity and quality of production
10. Transgenic organisms in agriculture - changes in biosynthetic pathways, use of plants and animals as "cell factories"
11. Biotechnology of livestock
12. Biotechnology in forestry and wood production

Recommended literature:

Khan, M.S. et al.: Applied Molecular Biotechnology. The Next Generation of Genetic Engineering. CRC Press, 2016, pp. 622, ISBN 978-1-4987-1483-9

New Techniques in Agricultural Biotechnology, European Union, 2017, pp. 152, ISBN 978-92-79-66222-5

Language, knowledge of which is necessary to complete the subject: English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: Prof. RNDr. Ján Kraic, PhD

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava

Faculty/institute: Faculty of Natural Sciences

Subject code: KBT/bd355 | **Subject name: Bachelor Project**

Type, scope, and method of educational activities: Compulsory subject. Profile subject.
Subject type (C, CO, O): C
Recommended scope of teaching (in hours): 8 hours of seminars per week
Study method: on-site
Study form: full-time study

Number of credits: 4

Recommended semester/trimester of study: semester 6

Level of study: bachelor

Prerequisite subjects: without prerequisite subjects

Conditions for completing the subject:

During the semester, students' independent work on assignments will be assessed as a prerequisite for passing the exam. At the end of the semester, the final thesis, the level of use of relevant literature sources, their processing and use, the level of processing and the final presentation of the thesis will be evaluated. This will be evaluated by a committee composed of members of the department and graded with a grade of A-Fx. The thesis itself will be based on the thesis topic and will contain a minimum of 54,000 characters with spaces and a minimum of 30 relevant citations.

Overall evaluation of the course:

A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>;
B - very good (above the average standard but with some errors) = 1.5 <83-91 %>;
C - good (generally sound work with a number of notable errors) = 2 <74-82 %>;
D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>;
E - sufficient (performance meets the minimum criteria) =3 <56-64 %>;
FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>

Educational outcomes:

The aim is

- development of intellectual and creative abilities, practical skills of the student,
- development and consolidation of habits of methodological discipline in the processing of the topic.

The student should demonstrate

- the ability to independently use the theoretical knowledge acquired by studying at the university,
- apply the knowledge in solving specific tasks
- demonstrate the ability to present and defend the work.

The result is the elaboration of a bachelor thesis. The outcome of the course is competence, i.e. the ability to independently develop a hypothesis, design an experiment to verify the hypothesis, process and evaluate the results in the form of a bachelor's thesis. The graduate is also able to solve problems during the experimental activity of the bachelor thesis and to propose appropriate procedures to modify the experiment. He/she is able to work independently in the laboratory, to communicate with experts within the scope of the thesis topic and to present his/her results to experts.

Brief content of the subject:

1. Overview of currently used scientific databases I (WoS, Scopus, PubMed, etc.).
2. Overview of currently used scientific databases II. (WoS, Scopus, PubMed, etc.).
3. Overview of currently used scientific databases III. (WoS, Scopus, PubMed, etc.).
4. Information retrieval and processing. Keywords.
5. Evaluation of the summarization of literature data and knowledge, use and interpretation of the information obtained, interim and final editing of the text.
6. Processing of experimental data, construction of graphs.
7. Evaluation and interpretation of results.
8. Preparation of the bachelor thesis.
9. Elaboration of the bachelor thesis.

10. Elaboration of the bachelor thesis.
11. Elaboration of the bachelor thesis.
12. Elaboration of the bachelor thesis.
13. Elaboration of the bachelor thesis

Recommended literature:
Books, journals and other literature according to the topic of the project

Language, knowledge of which is necessary to complete the subject: English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: Supervisors of the bachelor thesis

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd319	**Subject name: Balance Systems in Biotechnological Processes**
Type, scope, and method of educational activities: Compulsory subject. Profile subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 2 hours of seminars per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 3	
Recommended semester/trimester of study: semester 3	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: Attendance at the seminar. Successful completion of the final (written) exam. During the semester, the student takes 2 preliminary tests. To take the final exam, the student must obtain at least 51% of points from the preliminary tests. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: Upon successful completion of the course the student • acquires knowledge of the balance systems in biotechnological processes • acquires skills and competencies with the compilation of material and energy balances, with the balance of a multi-component system without chemical reactions and with chemical reactions; • defining currents and their composition; with the design of the balance scheme and balance table.	
Brief content of the subject: 1. Physical units, basic quantities and SI units, multiple and partial units, unit conversions, rounding 2. Quantity and flow of material, composition of mixtures, flow-through devices, batch devices 3. Balance systems, open, closed and isolated systems, computational relations 4. Definition of streams and their composition, a design of the balance scheme and the balance table 5. Material balances without chemical reaction - examples part 1 6. Material balances without chemical reaction - examples part 2 7. material balances without chemical reaction - balance system composed of several devices - examples part 3 8. Material balances with chemical reaction, stoichiometry, reaction range, degree of conversion of components - examples part 1 9. Material balances with chemical reaction - examples part 2 10. Material balances with chemical reaction - examples part 3 11. Enthalpy balance - total energy of the system, calculation relations - examples part 1 12. Enthalpy balance - examples part 2	
Recommended literature: *Colin Oloman (2009) Advances in Chemical and Process Engineering. https://doi.org/10.1142/p631* *Seyed Ali Ashrafizadeh, Zhongchao Tan (2018) Mass and Energy Balances. ISBN: 978-3-319-89166-8*	
Language, knowledge of which is necessary to complete the subject: English	
Subject evaluation	

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A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00
Notes:					
Teacher: Assoc. prof. Ing. Jana Moravčíková, PhD.					
Date of last change: 28.02.2022					
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd301	**Subject name: Basic Biology for Biotechnologists**
Type, scope, and method of educational activities: Compulsory subject. Profile subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 2 hours of lectures and 2 hours of seminars per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 5	
Recommended semester/trimester of study: semester 1	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: As a part of the continuous assessment, two tests will be written (in the 7th week of the semester and in the 12th week of the semester). It is mandatory for the student to obtain at least 50% of the points from each of the tests (condition for the final exam). The final evaluation of the course is a written exam (3 questions) followed by an oral examination. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: The student • will obtain basic knowledge of the biological aspects of the organization of life at cellular level in terms of structure, function, development, and evolution and practical importance. • will adopt a knowledge and terminology base; based on the basic knowledge he can understand the principles not only of the structure and composition, but especially the functional activities of pro- and eukaryotic cells and their subcellular structures. • will also acquire the knowledge and logical skills that are the basis and the necessary prerequisite for understanding the content of additional biologically oriented subjects.	
Brief content of the subject: 1. Introduction to general biology: definition, classification, terms. History of biological sciences, characteristics of special biological sciences. 2. Patterns and definition of living systems, general properties of living systems. 3. Genes as historical documents: molecular biology, living chronicles, information macromolecules, chronometers 4. Basic division of organisms, genesis of classification of organisms, plants versus animals. Biosphere and biosystems: classification of biosystems, classification, nomenclature. 5. Biological species. Problem of species, speciation, models and forms, mechanisms of reproduction isolation. Species in Prokaryotes. 6. Bacteria. Characteristics, body structure, properties. Biofilm. Bacterial taxonomy. The importance of bacteria in terms of biotechnological research. 7. Eukaryotic cell. Study methods. Cell theory, prokaryotic and eukaryotic cells, plant and animal cells. 8. Cellular organelles and their functions in cellular systems I. 9. Cellular organelles and their functions in cellular systems II. 10. DNA, cytogenetics. Chromosome, structure, properties and functions. DNA and RNA. Karyotype. 11. Cell proliferation: mitosis, meiosis, genetic aspects of cell division. 12. Basics of genetics, basic concepts and terminology. Basic stages of genetics development. Fundamentals of genetic engineering.	

13. Basics of molecular biology and genetics; principles, methods of study and basic applications in applied biological sciences. Extremophilic organisms; their aspects and applications in biotechnology.

Recommended literature:

Urry L., Cain M., Wasserman S., Minorsky P., Orr R.: Campbell Biology. Pearson Education 2021, 1504 pp. ISBN-13: 9780135988046

Victoria Aspinall, Melanie Cappello: Introduction to Animal and Veterinary Anatomy and Physiology. Bell and Brain Ltd. Glasgow 2019, 160 pp. ISBN-13: 978-1789241150

Madigan M.T. et al.: Brock Biology of Microorganisms, Global Edition. Pearson Education Limited, 2018, 1064 pp. ISBN: 9781292235103

Language, knowledge of which is necessary to complete the subject: English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: Assoc. Prof. RNDr. Michaela Havrlentová, PhD.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd323	**Subject name: Biochemistry**
Type, scope, and method of educational activities: Compulsory subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 2 hours of lectures per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 3	
Recommended semester/trimester of study: semester 3	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: Final test results. Participation on lectures in according with study rules. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: The lesson Biochemistry is one of the most important and basic lessons, which compress as well chemical as biological aspects about the existence and reality of living organisms. The lesson goal is: • to offer an over-look in the field of static and dynamic biochemistry by the way, • the student would be able to obtained knowledge´s applied within the other chemical and biological lessons and other courses.	
Brief content of the subject: 1. Prokaryotic, eukaryotic cell, morphology, organelles, mitosis, meiosis. 2. Amino-acids, peptidic bound, peptides, proteins, structure, functions. 3. Enzymes, definition, nature, terminology, mechanism, categorization, inhibition, cofactors. 4. Energy recovery, anaerobic oxidation, aerobic oxidation, respiratory chain, oxidative phosphorylation. 5. Basic biochemical pathways, glycolysis, Krebs cycle, pentose cycle. 6. Saccharides, definition, categorization, geometry, monosaccharides, oligosaccharides, polysaccharides. 7. Lipids, definition, categorization, fatty acids, sutured fatty acids, anabolism, catabolism of lipids, cell membranes, phospholipids, carotenoids, isoprenoids, sterols. 8. Nucleosides, nucleotides, definition, categorization, biosynthesis, nucleic acids, DNA, RNA, transcription, translation, chromatin, viruses. 9. Basic terms in genetic, heredity Mendel's rules, sexual heredity, heredity of blood groups, genetic defects. 10. Vitamins soluble in water, vitamins soluble in lipids, structure, importance, daily recommended dose, content in foods and raw material, hypervitaminosis, hypovitaminosis, avitaminosis. 11. Hormones definition, chemical hormones categories, hormone-producing glands. 12. Bioactive compounds, alkaloids, polyketides, terpenoids, phenolic acids, flavonoids, carotenoids, zeaxanthins, betalaines. 13. Repeating. 14. Final tes	
Recommended literature: *Lubert Stryer, Jeremy Berg, John Tymoczko, Gregory Gatto (2019) Biochemistry, Macmillan Learning, 1208, ISBN: 1319114652.* *Presented presentation in *.pptx format.*	

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Language, knowledge of which is necessary to complete the subject: English					
Subject evaluation					
A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00
Notes:					
Teacher: Assoc. Prof. Ing. Tibor Maliar, PhD.					
Date of last change: 28.02.2022					
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBF/bd322	**Subject name: Biophysical Chemistry**
Type, scope, and method of educational activities: Compulsory subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 2 hours of lectures and 3 hours of seminars **Study method:** on-site **Study form:** full-time study	
Number of credits: 5	
Recommended semester/trimester of study: semester 3	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: Participation in lectures and seminars. Participation in lectures. In total, a student may earn a maximum of 500 points. The student is required to obtain at least 56% of the points as per the guidelines. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: The student will • acquire the basic knowledge on thermodynamics and kinetics of living systems by successfully completing the course, • master the basic laws of thermodynamics, applied to reversible and irreversible events, can assess the direction of spontaneous events, • get acquainted with Gibbs energy, reaction kinetics of living processes, basics of electrochemistry and electrophysiology, as well as complex biochemical processes.	
Brief content of the subject: 1. Biomolecules: atoms, ions, chemical bonds, macromolecules and their structure, mass spectrometry, microscopy 2. State quantities, states, phase equilibria and transformations: Group states. Ideal and real gas, equations of state. 3. State changes, bond changes, immiscible and miscible liquids, colligative properties of solutions (ebulioscopy and cryoscopy), phase changes of biopolymers and aggregates. 4. Calorimetry. 5. Laws of thermodynamics: Laws of thermodynamics 0-IV. Energy, work and heat. Internal energy, enthalpy, entropy, Gibbs energy, hydrophobic interactions. 6. Energy conversion - photosynthesis, ATP production, metabolism. 7. Thermodynamics of ions and electron transport, ion transport across the membrane. 8. Kinetics of living processes: reaction kinetics, complex biochemical processes, energy, kinetics and mechanism of enzyme reactions and Gibbs energy, examples of enzyme function. 9. pH: principle, pH calculation, determination of pH in solution, in water, resp. in soil, blood and cells (electrodes and optical methods). Protonation and deprotonation, redox reactions, pH titration. 10. Basics of electrochemistry and electrophysiology, Nernst equation, calculation of resting potential, conductivity, formation of neuronal action potential, action potential of plants. 11. Reaction mechanisms: chemical equilibrium, kinetics, diffusion and diffusion coefficient, osmosis, thermodynamic equilibrium. Equilibrium and transport phenomena in solutions of electrolytes and biopolymers, polymerization.	

12. Complex biochemical processes: enzymes, Michaelis-Menten relationship, catalysis, ion movement across membranes, microscopic systems and their quantification, Arrhenius equation, facilitated and active transport processes.

Recommended literature:

Peter Atkins a Julio de Paula, 2011, Physical Chemistry for the Life Sciences, 2nd edition. W.H Freeman and Company, USA, ISBN-10: 1-4292-3114-9
Steven Rose, 1999, The chemistry of life, 4th Edition, Pengium Science

Language, knowledge of which is necessary to complete the subject: English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: prof. Mgr. Alžbeta Marček Chorvátová, DrSc.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd305	**Subject name: Calculation Seminar I**
Type, scope, and method of educational activities: Compulsory subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 2 hours of seminars per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 4	
Recommended semester/trimester of study: semester 1	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	

Conditions for completing the subject:

Verification of knowledge during the semester in the form of tests consisting of the calculations discussed. Participation in classes in accordance with the UCM study regulations.

Overall evaluation of the course:

A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>;
B - very good (above the average standard but with some errors) = 1.5 <83-91 %>;
C - good (generally sound work with a number of notable errors) = 2 <74-82 %>;
D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>;
E - sufficient (performance meets the minimum criteria) =3 <56-64 %>;
FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>

Educational outcomes:

After completing the calculations seminar, the student

- clarifies and consolidates the theory covered and, in addition, creates a basis for smooth completion of laboratory exercises,
- the student masters the basic chemical calculations used in general and inorganic chemistry.

Brief content of the subject:

1. basic formulas, units, unit conversions, chemical nomenclature.
2. quantity of a substance - substance quantity (substance quantity and mass of a substance, substance quantity and volume of a substance);
3. composition of systems - proportional expression of the composition of systems,
4. composition of systems - density of solutions,
5. concentration expression of the composition of the systems,
6. molality;
7. substance balances in systems without chemical processes - preparation of solutions (dissolution of solids);
8. balances of matter in systems without chemical processes - preparation of solutions (mixing of solutions of different composition);
9. substance balances in systems without chemical processes - preparation of solutions (dilution of concentrated solutions);
10. substance balances in systems without chemical processes - preparation of solutions by solvent evaporation, crystallization);
11. substance balances in systems with chemical processes;
12. calculation of pH of solutions (strong acids/bases, weak acids/bases, calculation of pH of buffer solutions).

Recommended literature:

http://www.tycmhoffman.com/commonfiles/bio354/Laboratory01.pdf
Seidman, L.: Basic Laboratory Calculations for Biotechnology. 2nd Edition. ISBN 9780429282744.
Stephenson, F.H. Calculation for Molecular Biology and Biotechnology. A Guide to Mathematics in the Laboratory. 2nd Edition. ISBN 978-0-12-375690-9.
http://parasitology.sbmu.ac.ir/uploads/Calculations_for_Molecular_Biology.pdf

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Language, knowledge of which is necessary to complete the subject: English					
Subject evaluation					
A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00
Notes:					
Teacher: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					
Date of last change: 28.02.2022					
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					

University of Ss. Cyril and Methodius in Trnava
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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd313	**Subject name: Calculation Seminar II**
Type, scope, and method of educational activities: Compulsory subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 2 hours of seminars per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 4	
Recommended semester/trimester of study: semester 2	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: Verification of knowledge during the semester in the form of tests consisting of the calculations discussed. Participation in classes in accordance with the UCM study regulations. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: Student after completing the calculations seminar • clarifies and consolidates the theory covered and, in addition, creates a basis for smooth completion of laboratory exercises • the student masters the basic chemical calculations used in biotechnology.	
Brief content of the subject: 1. Basic calculations used in microbiology (preparation of culture media). 2. Basic calculations used in microbiology (proportional expression of composition of systems). 3. Basic calculations used in microbiology (dilution). 4. Basic calculations used in microbiology. 5. Basic calculations used in biochemistry (application of linear and non-linear regression to the analysis of experimental data). 6. Basic calculations used in biochemistry (application of linear and non-linear regression to the analysis of experimental data). 7. Basic calculations used in biochemistry (statistical processing of results - verification of accuracy and correctness of results). 8. Basic calculations used in biochemistry (verification of accuracy and correctness of results). 9.-12. Calculations for the evaluation of technological processes.	
Recommended literature: *Seidman, L.: Basic Laboratory Calculations for Biotechnology. 2nd Edition. ISBN 9780429282744.* *Stephenson, F.H. Calculation for Molecular Biology and Biotechnology. A Guide to Mathematics in the Laboratory. 2nd Edition. ISBN 978-0-12-375690-9.* *http://parasitology.sbmu.ac.ir/uploads/Calculations_for_Molecular_Biology.pdf*	
Language, knowledge of which is necessary to complete the subject: English	

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

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Date of last change: 28.02.2022
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd353	**Subject name: Computer-aided Molecular Design**
Type, scope, and method of educational activities: Compulsory subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 3 hours of seminars per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 3	
Recommended semester/trimester of study: semester 5	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: Final test results. Participation on lectures in according with study rules, commitment of current work for each lesson. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: The subject goal is • a study of modern method and approaches applied in desing, research and development of new compounds and materials within *de novo* construction of active molecules (CAMD COMPUTER-AIDED MOLECULAR DESIGN).	
Brief content of the subject: 1. The mediation of new knowledges to student from the field of molecular principles of new materials and drugs with application CAMD. 2. The search of the compounds (molecules) with potential therapeutic effect, which fulfill following criteria (high and specific efficiency, minimal toxicity, good bioavailability). 3. Application of computers, informatics, statistics and mathematics. 4. Application of computer and chemical software's. 5. Application of computer and physical software's. 6. Application of computer and medicinal software's. 7. Application of computer graphics for displaying of chemical structures. 8. Application of computer graphics for manipulation with chemical structures aimed the synthesis of new molecules, conformation analysis and estimation of conformity to chosen standard in silico. 9. The calculation of interaction energy between drug candidate molecules and hypothetical or experimentally measured macromolecule structures (receptors, targets). 10. The explanation of the recognition aspects of „ligandov"on molecular level. 11. Stimulation of the creativity about R&D of new molecules. 12. Final test.	
Recommended literature: *Mithun Rudrapal, Chukwuebuka Egbuna, Computer Aided Drug Deisgn (CADD): From Ligand-Based Methods to Structure-Based Approaches, 1-st edition, Elsevier, ISBN: 9780323906081, 325 p., E-material in *.docx format.*	
Language, knowledge of which is necessary to complete the subject: English	
Subject evaluation	

A	B	C	D	E	FX

0.00	0.00	0.00	0.00	0.00	0.00
Notes:					
Teacher: Assoc. Prof. Ing. Tibor Maliar, PhD.					
Date of last change: 28.02.2022					
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					

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INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KER/bd318	**Subject name: Environmental Biotechnology**
Type, scope, and method of educational activities: Compulsory subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours): 2 hours of lectures and 1 hour of seminar** **Study method:** on-site **Study form:** full-time study	
Number of credits: 3	
Recommended semester/trimester of study: semester 3	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: To pass the course successfully students must take a written examination in the 8th week of the semester. The student must obtain at least 51 %. From tasks at the seminar student needs to get at least 51 %. The evaluation of the course consists of the evaluation of the semester part of the course (min. 16 points, max. 30 points) and the examination part of the course (min. 36 points and max. 70 points). The exam part consists of a written and an oral exam. In total, the student can get 100 points. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: Upon successful completion of this course, the student will gain: • knowledge and partial skills in the use of biotechnological processes in the purification of various components of the environment, in the removal of wastes; • knowledge and competences on the latest possibilities of using technologies in accordance with the principles of circular economy and sustainable development, also from the point of view of environmental protection and restoration.	
Brief content of the subject: 1. Introduction to biotechnology, history of environmental biotechnology. 2. EU strategy for industrial and environmental biotechnology. 3. Eco-industrial park. 4. Eco-housing and bio-garden. 5. Water pollution. Biological wastewater treatment. Nitrification, denitrification. Water treatment in wastewater treatment plants. Treatment of sewage sludge. 6. Eutrophication. Biotechnology for macronutrient removal. Open and closed culture systems. 7. Bioremediation - general introduction. Biodegradation of wastes. 8. Use of organisms in air treatment. 9. Phytoremediation. Use of plants in water and soil treatment. Application of phytoremediation in practice. Phytomining. 10. Biomimetics. 11. Bioplastics. 12. Biorefinery.	
Recommended literature: *Kadukova J, Kavulicova J (2010) Phytoremediation and Stress, Evaluation of Heavy Metal-Induced Stress in Plants, Nova Science Publishers, Inc., New York.*	

Yamanaka T (2008) Chemolithoautotrophic Bacteria (Biochemistry and Environmental Biology), 1st edn, Springer.					
Language, knowledge of which is necessary to complete the subject: English					
Subject evaluation					
A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00
Notes:					
Teacher: Assoc. Prof. RNDr. Miroslav Horník, PhD.					
Date of last change: 28.02.2022					
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd352	**Subject name: Enzyme Biotechnology**
Type, scope, and method of educational activities: Compulsory subject. Profile subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 2 hours of lectures per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 3	
Recommended semester/trimester of study: semester 6	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: Students' academic performance will be tested during the semester with three midterm tests and a final exam, and only students who score at least 50% on the midterm tests will be allowed to take the exam. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: Students will be • become familiar with the production and finalization of enzymes in the form of active ingredients used in various industrial applications, the practical use of different classes of enzymes in different areas of industrial practice with emphasis on their mechanism of action and forms of application in specific technological processes. • In addition, it will be pointed out the possibilities of making the processes catalysed by the enzymes in question more efficient by means of molecular biology tools on the basis of the results of bioinformatic analyses..	
Brief content of the subject: 1. Industrial production of enzymes to meet the demand for biocatalysts in different sectors of the national economy 2. Enzyme engineering as a tool to understand and improve the function of currently used enzyme biocatalysts 3. Agricultural applications of enzymology knowledge to improve production efficiency with a focus on crop production 4. Agricultural applications of enzymology knowledge to improve production efficiency with a focus on livestock production 5. Food applications of enzymology knowledge to the production of selected food products 6. Non-food industrial applications of enzymology knowledge in selected areas of industrial production - enzyme-based cleaners 7. Non-food industrial applications of enzymology knowledge in selected areas of industrial production - textiles, paper, etc. 8. Enzymatic biotransformations used mainly in the field of bioorganic chemistry 9. Application of enzymology knowledge in medicine in the analysis and treatment of selected infectious diseases 10. Medical applications of enzymological knowledge for the analysis and treatment of selected diseases of civilization 11. Bioanalytical application of enzymological knowledge for the preparation of specific procedures enabling the efficiency of currently used analytical methods by the application of enzymes 12. Biosensors and biochips.	

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Recommended literature:

Gray, N., Calvin, M., Bhatia, S.C.: Enzymes Biotechnology. CBS Publisher & Distributors P Ltd. 2010, ISBN 9788123918297.

Bhatt, S.M.: Enzymology and Enzyme Biotechnology. S. Chand Publisher, 2011, ISBN 8121935849.

Wiseman, A.: Handbook of Enzyme Biotechnology. ISBN 0470201533.

Language, knowledge of which is necessary to complete the subject: English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd345	**Subject name: Enzymology**
Type, scope, and method of educational activities: Compulsory subject. Profile subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 2 hours of lectures per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 3	
Recommended semester/trimester of study: semester 5	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: Students' academic performance will be tested during the semester with three midterm tests and a final exam, and only students who score at least 50% on the midterm tests will be allowed to take the exam. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: Upon successful completion of the course, the student is • will be able to describe the basic structural and functional characteristics of enzymes • apply a strategy for selecting the appropriate enzyme for a specific application on an industrial scale • be able to calculate the need for a given enzyme for a given application and calculate the effect of possible interactions of substances with inhibitory activity.	
Brief content of the subject: 1. Historical overview of enzyme research and use. 2. Basic aspects of enzymes as biocatalysts present in living organisms 3. Structure of enzymes present in living organisms 4. Options for improving enzymes in the context of creating artificial diversity of biocatalysts 5. Basic classification of enzymes in terms of catalytic efficiency. 6. Regulatory mechanisms of enzyme production in terms of activation by proenzymes, regulation by allosteric effectors and inactivation by inhibitors. 7. Enzyme kinetics, Michaelis-Menten dependence and linearization of this dependence 8. Methods for determining enzyme activity used in research as well as for assessing their presence in biological material 9. Qualitative and quantitative evaluation of enzymes - calculation of activity and kinetic parameters of enzyme reactions and action of inhibitors. 10. Qualitative and quantitative evaluation of enzymes - calculation of enzyme and inhibitory activity - for example, sucrase. 11. Qualitative and quantitative evaluation of enzymes - calculation of enzyme and inhibitory activity - example of amylase 12. Qualitative and quantitative evaluation of enzymes - calculation of enzyme and inhibitory activity - using lipase as an example	
Recommended literature: *Buchholz K., Kasche V., Bornschauer U.T.: Biocatalysts and enzyme technology. Viley-V.Ch, Weinheim 2005, 400 pp.*	

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Gray, N., Calvin, M., Bhatia, S.C.: Enzymes Biotechnology. CBS Publisher & Distributors P Ltd. 2010, ISBN 9788123918297.
Bhatt, S.M.: Enzymology and Enzyme Biotechnology. S. Chand Publisher, 2011, ISBN 8121935849.

Language, knowledge of which is necessary to complete the subject: English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd356	**Subject name: Experimental Activities for the Bachelor Thesis**
Type, scope, and method of educational activities: Compulsory subject. Profile subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 10 hours of laboratory exercises per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 5	
Recommended semester/trimester of study: semester 6	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: Experimental activity on the topic. Elaboration of the experimental part of the bachelor thesis. Evaluation of results. Discussion with literature. Comprehensive bachelor thesis consisting of literature search and experimental activity. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: At the end of the semester, skills in laboratory techniques, advanced knowledge of chemistry, biochemistry, biology and biotechnology in relation to the topic of the bachelor's thesis. The outcome of this subject is • The ability to formulate a hypothesis and design an appropriate experiment or set of experiments to confirm it, • evaluate an experiment, • elaborate the results in a bachelor thesis, • the ability to solve problems during the experimental activity of the bachelor thesis and to propose appropriate procedures to modify the experiment, • the ability to work independently in the laboratory, to interact with experts within the scope of the topic of their thesis and to present their results to experts.	
Brief content of the subject: Experimental activity under the guidance of the thesis supervisor, which is a compulsory part of the bachelor thesis. In this course, the student has enough time to carry out the experimental part of the bachelor thesis, to write up the results, as well as to evaluate them and compare them with foreign literature.	
Recommended literature: *Books, journals and other literature according to the topic of the bachelor thesis.*	
Language, knowledge of which is necessary to complete the subject: English	

Subject evaluation					
A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:
Teacher: Supervisors of the bachelor thesis
Date of last change: 28.02.2022
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd306	**Subject name: Fundamentals of Biotechnological Processes and Equipment**
Type, scope, and method of educational activities: Compulsory subject. Profile subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 2 hours of lectures per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 3	
Recommended semester/trimester of study: semester 1	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: Attendance at the lectures. Successful completion of the final (oral) exam. During the semester, the student takes 2 preliminary tests. To take the final exam, the student must obtain at least 51% of points from the preliminary tests. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: Upon successful completion of the course, the student • acquires knowledge about the basic processes taking place in biotechnological production and • acquires knowledge about the equipment used in the production sphere of biotechnological focus The knowledge gained by completing this course will allow the student to better respond to the needs of production practice and faster to fully integrate into the production process.	
Brief syllabus: 1. Introduction to the course, basic manufacturing operations and their distribution 2. Continuous and discontinuous methods of production, storage and transport of solids, liquids and gases 3. Mechanical operations - solids treatment, fluidization, conventional filtration and cross-flow filtration, membrane filtration 4. Mechanical operations - centrifugation and types of centrifuges, settling, mixing 5. Diffusion operations - distillation, rectification and rectification columns 6. Diffusion operations - absorption and adsorption and equipment, crystallization and crystallization equipment 7. Diffusion operations - extraction and extraction equipment; drying - drying methods and types of dryers 8. Thermal operations - heating and cooling, heat recovery, heat transfer, heat exchangers with direct and indirect heat exchange 9. Water in biotechnological processes, water treatment and industrial wastewater treatment 10. Reactors and bioreactors, sterilization of equipment, sterilization and pasteurization 11. Packaging and storage of products, the role of packaging and trends in packaging materials with respect to the environment 12. Principles of Green chemistry in biotechnology	
Recommended literature:	

Fellows P.J. (2009) Food processing Technology, Principles and Practice. Woodhead Publishing Ltd Cambridge a CRC Press, Boca Raton
Toledo R.T. Fundamentals of Food Engineering. Aspen Publishers, Inc. VCH Publishers, Inc. New York, USA
Mandhyan B.L. (2020) Food Process Engineering And Technology. New India Publishing Agency NIPA

Language, knowledge of which is necessary to complete the subject: English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: Assoc. prof. Ing. Jana Moravčíková, PhD.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd3	**Subject name: Fundamentals of Microbiology**
Type, scope, and method of educational activities: Compulsory subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours): 2 hours of lectures and 1 hour of seminar** **Study method:** on-site **Study form:** full-time study	
Number of credits: 3	
Recommended semester/trimester of study: semester 4	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	

Conditions for completing the subject:

1.) participation in teaching in accordance with the UCM Study Regulations in Trnava;
2.) preparation and presentation of a selected topic in the field of microbiology;
3.) active participation in seminars, discussion of presentations (consideration in the overall evaluation of the subject);
4.) written test (30 questions);
5.) oral exam

Overall evaluation of the course:

A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>;
B - very good (above the average standard but with some errors) = 1.5 <83-91 %>;
C - good (generally sound work with a number of notable errors) = 2 <74-82 %>;
D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>;
E - sufficient (performance meets the minimum criteria) =3 <56-64 %>;
FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>

Educational outcomes:

Upon successful completion of the course, the student acquire

- basic knowledge about the structure and function of microorganisms, microbial diversity and their evolution, the ecology and living in different environments,
- as well as about their interaction with macroorganisms - plants, animals and humans.

Brief content of the subject:

1. Introduction to the world of microorganisms. Definition and subject of microbiology. Microbiological sciences. History of microbiology - roots and transition to the modern era. Methods and methodology of microbiology.

2. Structure of microorganisms. Biomacromolecules. Cellular and non-cellular microorganisms. Prokaryotic cell morphology and anatomy. Morphology and anatomy of the eukaryotic cell.

3. Microbial metabolism.. Metabolic diversity - chemotrophy and phototrophy. Biochemical processes - catabolism and anabolism. Oxidation and fermentation. Metabolic pathways. Microbial bioenergetics.

4. Nutrition of microorganisms. Nutrients. Sources of nutrients. Nutrient intake. Nutrient transport. Excretion of substances. Growth substances and factors.

5. Growth and reproduction of microorganisms. Cell growth and reproduction. Growth cycles Population growth. Growth and environment. Control and inhibition of microbial growth - antimicrobials.

6. Molecular biology and genetics of microorganisms. Structure of prokaryotic genome. Eukaryotic genome structure. Genome replication. Gene expression. Mutations and recombination. Gene transfer. Viral genetics.

7. Microbial evolution and taxonomy of microorganisms. Origin and diversity of organisms. Classification and nomenclature of microorganisms. Classical versus modern systematics. Macroclassification of microorganisms. Taxonomic exclusivity of viruses.

8. Biology and diversity of prokaryotic microorganisms. Characteristics of prokaryotes. Prokaryotic diversity: Archeons. Prokaryotic diversity: Bacteria.

9. Biology and diversity of eukaryotic microorganisms. Characteristics of eukaryotes. Eukaryotic diversity: Micromycetes. Eukaryotic diversity: Microalgae. Eukaryotic diversity: Protozoa.

10. Microbial ecology. Microorganisms in the biosphere. Microbial populations, communities and ecosystems. Terrestrial environments. Aquatic habitats. Extreme habitats. Microorganisms and biogeochemical cycles. Interactions between microorganisms and macroorganisms.
11. Microorganisms and infectious diseases. Host-parasite relationship. Pathogenicity and virulence. Infection and immunity. Microorganisms in health and disease - microbial infections.
12. Applied microbiology. Microorganisms in human service - biotechnology. Education in microbiology. Microorganisms and the world of distant planets - cosmic microbiology. Microorganisms and the future of man - futurological vision

Recommended literature:

Hofkin: ***Living in a microbial world.*** *GS Taylor & Francis Group, 2011.*
Baker, Griffiths, Nicklin: ***Microbiology.*** *GS Taylor & Francis Group, 4. vydanie, 2011.*
Madigan, Bender, Buckley, Sattley, Stahl: ***Brock Biology of Microorganisms.*** *15. vydanie Prentice Hall Inc., 2019*

Language, knowledge of which is necessary to complete the subject: English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: doc. RNDr. Milan Seman, CSc.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

University of Ss. Cyril and Methodius in Trnava
Námestie Jozefa Herdu 2
917 01 Trnava

SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KCH/bd303	**Subject name: General Chemistry**
Type, scope, and method of educational activities: Compulsory subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours): 2 hours of lectures and 2 hours of seminars** **Study method:** on-site **Study form:** full-time study	
Number of credits: 5	
Recommended semester/trimester of study: semester 1	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: Participation in lectures and seminars. There will be 2 written examinations during the semester, each for 25 points. The student must obtain at least 50% of each point. The exam will have a written and oral part, for a total of 50 points. In total, the student can get 100 points. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: Upon successful completion of the course, the student: • demonstrably masters the basic conceptual apparatus of chemistry, nomenclature of inorganic compounds and simple coordination compounds; • understands the basis of the physical nature of matter, the structure of the atom, the basis of chemical bonding, the properties of molecules and substances, the basis of thermodynamics and reaction kinetics, chemical equilibrium, theories of acids and bases and the basic type of chemical reactions; • has the knowledge necessary for the completion of other chemical subjects, can use the acquired knowledge in solving practical tasks.	
Brief content of the subject: 1. Chemical objects. Matter and its properties. Quantities. Particles of matter. Nomenclature of inorganic substances. 2. Atomic structure of substances. Elements. Chemical formulas. Chemical bonding. Substance balances. Amount of pure substance. Chemical systems. Solutions. Balances of mass, charge and chemical reactions. 3. Energy balance. Energy conservation law. Thermodynamic systems, quantities and processes. Heat and work. Energy and enthalpy. Thermochemistry. Spontaneity of processes. Entropy and Gibbs energy. 4. Fluids. State of matter. Gases and liquids. Structure of solids. Ionic and metallic bond. 5. Physical transformations. Phase transitions. Phase transitions in solids. Solvents. Dissolution. Distribution of binary mixtures. 6. Chemical equilibrium. Chemical reactions. Reaction Gibbs energy. Equilibrium constant. Dependence of equilibrium constant on temperature and pressure. 7. Chemical kinetics. Rate equation. Rate constant and activation energy. Catalysis. 8. Acid-base reactions. Acids and bases. Autoprotolysis. Ionization of acids and bases. Neutralization. Hydrolysis. Buffers and indicators.	

9. Redox reactions. Oxidizing agents and reducing agents. Electrode potential. Electrolysis.
10. Electronic structure of an atom. Fundamentals of quantum theory. Hydrogen atom. Multi-electron atoms. Periodic law.
11. Chemical bonding and chemical structure. Characteristics of the chemical bond. Physical nature of the chemical bond. Molecular orbitals. Theory of localized electron pairs. Hybridization.
12. Intermolecular interactions. Electric moments. Types of intermolecular interactions. Hydrogen bond.
13. Electrical, magnetic, optical and thermal properties of substances.

Recommended literature:

D. A. McQuarrie, P. A. Rock, E. B. Gallogly: General Chemistry, University Science Books, 2011.

Language, knowledge of which is necessary to complete the subject: English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: Prof. RNDr. Ján Titiš, PhD.; Prof. Ing. Roman Boča, DrSc.; RNDr. Beata Vranovičová, PhD.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

University of Ss. Cyril and Methodius in Trnava
Námestie Jozefa Herdu 2
917 01 Trnava

SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd310	**Subject name: Information and Communication Technologies**
Type, scope, and method of educational activities: Compulsory subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 2 hours of seminar per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 3	
Recommended semester/trimester of study: semester 2	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: 1. Attending class and completing ongoing assignments. 2. Evaluation of the final test. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: The aim of the course is • to acquire skills in the use of basic information and communication technology tools, which are essential for further studies in the field, and specialized biotechnology-oriented databases for obtaining basic information in the field. • The skills acquired will be verified by the completion of intermediate assignments and a final test.	
Brief content of the subject: 1., 2. - Training of specific activities in MS Office applications (Word, Excel PowerPoint) in order to prepare a record of processed information in text, tabular and graphical form I, II 3., 4. - Practicing specific activities in MS Office applications (Word, Excel PowerPoint) in order to prepare a record of processed information in text, tabular and graphical form III, IV 5., 6. - Practicing specific activities in MS Office applications (Word, Excel PowerPoint) in order to prepare a record of processed information in text, tabular and graphical form V, VI 7., 8., 9. - Work with databases of scientific articles /Pubmed, ScienceDirect, Scopus etc/ VII-IX 10., 11., 12. - Presentation of individual tasks in the form of a presentation in *.ppt format X-XII	
Recommended literature: *MICROSOFT OFFICE 365 ALL-IN-ONE FOR BEGINNERS & POWER USERS: The Concise Microsoft Office 365 A-Z Mastery Guide for All Users (Word, Excel, PowerPoint, Access, SharePoint, & Publisher). ISBN 979-8458496650.* *Thomas, C.G. Research Methodology and Scientific Writing. 2nd Edition. Springer, 2021. ISBN 3030648648.*	
Language, knowledge of which is necessary to complete the subject: English	

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:
Teacher: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.
Date of last change: 28.02.2022
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

University of Ss. Cyril and Methodius in Trnava
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917 01 Trnava

SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KCH/bd311	**Subject name: Inorganic Chemistry**
Type, scope, and method of educational activities: Compulsory subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours): 3 hours of lectures per week** **Study method:** on-site **Study form:** full-time study	
Number of credits: 3	
Recommended semester/trimester of study: semester 2	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: Participation in lectures and seminars. There will be 2 written examinations during the semester, each for 25 points. The student must obtain at least 50% of each point. The exam will have a written and oral part, for a total of 50 points. In total, the student can get 100 points. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: Upon successful completion of the course, the student: • knows the periodic system of elements and the system of inorganic substances with a focus on compounds of s, p and d elements; • understands the relationship between the structure of compounds and their physical and chemical properties and the typical chemical reactions in which they participate; • has knowledge of their application in practice; • has theoretical knowledge of safety and principles of work in a chemical laboratory.	
Brief content of the subject: 1. Subject of inorganic chemistry. Nomenclature of coordination compounds. 2. Structure of solids. 3. Hydrogen. Rare gases. Halogens. 4. Oxygen, sulfur and a subgroup of selenium. 5. Nitrogen, phosphorus and arsenic subgroup. 6. Carbon, silicon and subgroup of germanium. 7. Boron, aluminum and gallium subgroup. Beryllium magnesium and alkaline earth metals. 8. Alkali metals. Scandinium subgroup. 9. Coordination and organometallic compounds. 10. Subgroup of titanium, vanadium and chromium. 11. Subgroup of manganese, iron and cobalt. 12. Subgroup of nickel, copper and zinc. 13. Lanthanides, actinides.	
Recommended literature: *J. E. House: Inorganic Chemistry, Elsevier, 2013.*	
Language, knowledge of which is necessary to complete the subject: English	
Subject evaluation	

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00
Notes:					
Teacher: Assoc. Prof. RNDr. Cyril Rajnák, PhD.; Prof. RNDr. Ján Titiš, PhD.					
Date of last change: 28.02.2022					
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					

University of Ss. Cyril and Methodius in Trnava
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917 01 Trnava

SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd300	**Subject name: Introduction to Biotechnology**
Type, scope, and method of educational activities: Compulsory subject. Profile subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 2 hours of lectures per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 3	
Recommended semester/trimester of study: semester 1	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: Successful completion of the oral exam. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: As this is the first and introductory course in the biotechnology, by completing the course the student will gain: • knowledge and overview of biotechnologies, specification of biotechnologies and their use • be able to explain the basis of biotechnological processes and the main components of these processes • an overview about the wide range of biotechnology applications in industry, pharmacy and medicine, agriculture, food production, environment, energy production After completing of this course, student will receive: • knowledge for training in related biotechnology subjects focused in more detail to specific uses and applications. As part of acquiring skills, the student will: • be able to identify the basic elements of biotechnology involved in experiments and production technologies of different products and to approach them. Completion of the course Introduction to Biotechnology will give the student: • initial competencies for the future education and acquisition of the ability to select and design biotechnological experiments, biotechnological production processes in various volume scales and to identify key elements in them (producer, substrate, process) will be able to consider the possible integration of biotechnologies into experimental and production practices, also where they have not been used before.	
Brief syllabus: 1. Biotechnology - characteristics, milestones of development, division of biotechnologies 2. Substrates for biotechnology - raw materials, biomass, producers 3. Bioreactors for biotechnologies, mini- and micro-bioreactors, photobioreactors 4. Microbial fermentations, microorganisms for industrial biotechnology 5. Microbial industrial biotechnologies, microbial enzymes produced biotechnologically and their applications 6. Biotechnology in biofuel production - biofuels, alkanes, methane and biogas, organic acids and alcohols, bioethanol, hydrogen, electricity 7. Biotechnology for food production - products produced by fermentations: alcoholic beverages, vinegar, dairy products, meat and fish products, plant products	

8. Biotechnology for food industry - food additives and additives, microbial biomass
9. Biotechnology for pharmacy and medicine - antibiotics, alkaloids, steroids, vaccines, therapeutic proteins, gene therapy and stem cells, biological weapons and bioterrorism
10. Biotechnology for environment - biodegradation, wastewater and sludge, composting, landfilling, bioremediation
11. Biotechnology for agriculture - plants for humans, plant breeding, micropropagation, pathogen-free plants, plant conservation, somatic variability, secondary metabolites, biofertilization and biostimulation
12. Biotechnology for agriculture - genetic modifications, transgenic plants

Recommended literature:

Godbey, W.T.: An Introduction to Biotechnology. The Science, Technology and Medical Applications. Academic Press, 2014, pp. 414, ISBN 978-1-907568-28-2
Smith, J.E.: Biotechnology. Cambridge University Press, 2009, pp. 266, ISBN 978-0-511-46394-5
Ratledge, C., Kristiansen, B.: Basic Biotechnology. Cambridge University Press, 2012, pp. 660, ISBN 9780511802409

Language, knowledge of which is necessary to complete the subject: English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: Prof. RNDr. Ján Kraic, PhD.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

University of Ss. Cyril and Methodius in Trnava
Námestie Jozefa Herdu 2
917 01 Trnava

SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBF/bd314	**Subject name: Introduction to Physics**
Type, scope, and method of educational activities: Compulsory subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours): 2 hours of lectures and 2 hours of seminars** **Study method:** on-site **Study form:** full-time study	
Number of credits: 5	
Recommended semester/trimester of study: semester 2	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: Participation in lectures and seminars. Attendance at lectures. In total, the student can get a maximum of 500 points. The student must obtain at least 56% of points. The evaluation of the exam is: 280 - 324 points "E", 325 - 369 points "D", 370 - 414 points "C", 415 - 459 points "B" and 460 - 500 points. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: • The aim of the course is to provide students with acquired basic knowledge in the field of physics, in all areas from mechanics, through thermics and thermodynamics, electricity and magnetism, as well as optics, biophotonics and atomic and nuclear physics.	
Brief content of the subject: 1. Mechanics I, Fundamentals of classical and quantum mechanics, understanding the differences between the motion of a body and the motion of a particle at the level of molecules and atoms. 2. Energy and strength. Energy conservation law, energy transfer, types of forces in nature, energy use by living systems: metabolism vs. photosynthesis. 3. Mechanics II, Mechanical oscillations and waves, harmonic oscillator, resonance. Fluid mechanics vs. solid phase. Basic equations of hydrostatics and hydrodynamics. 4. Pressure and compressive force, Surface tension of fluids. Examples of microfluidics and micromechanics of biopolymers in living systems (blood flow in blood vessels, heart function). 5. Thermals and thermodynamics. Temperature measurement and the concept of temperature, thermal expansion of substances. 6. Diffusion. Basic laws, equation of state of an ideal gas, Carnot cycle. Laws of thermodynamics, thermal oscillations of particles, thermodynamics of living systems, Brown's motion. 7. Electricity and magnetism. Electromagnetic field, understanding the terms intensity, potential, capacity and electric current. Electrical circuit and Ohm's law. 8. Magnetic induction, ferromagnetism, diamagnetism, paramagnetism. Faraday's law, electromagnetic oscillations and waves, cell electrical circuit, membrane potential, basics of electrophysiology. 9. Optics, waves, light. Fundamentals of geometric optics, the law of reflection and refraction. Spectrometry, fluorimetry and chromatography. Interference and diffraction of light, basics of microscopy, spectroscopy and fluorescence. Main optical devices and light sources (eg laser), basics of optical experiment. Examples of biophotonics, bioluminescence and endogenous fluorescence in wildlife.	

10. Atomic and nuclear physics. Electronic envelope of an atom, energy states, radioactive decay, use of radioactivity, detection of radioactive radiation, the effect of radiation on biological systems.
11. Law of radioactive decay, detection of radioactive radiation, ionization. Regularities of atomic spectra. Periodic table of elements
12. Chaos, order, space-time. Understanding the concept of time, the arrangement of matter from chaos to organized matter - examples of chemical reactions, self-assembly, fractals and chaos theory, the concept of space-time, the arrangement of matter from nanometers to kilometers, the structure of living matter from atoms to ecosystems, the structure of proteins.

Recommended literature:

Feynman lectures from physics I-IV.
Benjamin Crowell 2015, Simple Nature, An Introduction to physics for engineering and Physical Science Students. Fullerton, California.

Language, knowledge of which is necessary to complete the subject: English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: prof. Mgr. Alžbeta Marček Chorvátová, DrSc.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

University of Ss. Cyril and Methodius in Trnava
Námestie Jozefa Herdu 2
917 01 Trnava

SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd309	**Subject name: Laboratory Exercise in Advanced Biology**
Type, scope, and method of educational activities: Compulsory subject. Profile subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 4 hours of laboratory exercises per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 4	
Recommended semester/trimester of study: semester 2	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	

Conditions for completing the subject:

100% attendance at laboratory exercises is essential; in unavoidable cases (health reasons) attendance is excused but conditional on making up the missed laboratory exercise (20 points). Preparation and submission of protocols for the following exercise (20 points) and preparedness for each laboratory exercise, assessed by a short introductory test on the topic to be covered in the laboratory exercise (5 questions), followed by an oral examination and a check of the notes, tables and calculations in the laboratory exercise notebook (50 points), are essential. Successful completion of the course will require a final laboratory exercise in which the student demonstrates independent work towards the correct outcome (a minimum of 6 points out of a maximum of 10 points is required to pass the final laboratory exercise).

Overall evaluation of the course:

A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>;
B - very good (above the average standard but with some errors) = 1.5 <83-91 %>;
C - good (generally sound work with a number of notable errors) = 2 <74-82 %>;
D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>;
E - sufficient (performance meets the minimum criteria) =3 <56-64 %>;
FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>

Educational outcomes:

Student

- be able to apply basic knowledge for work in the biology laboratory and use simple know-how in carrying out tasks in the laboratory under the supervision of the teacher, such as the correct preparation of solutions, simple separation methods, simple measurements and observations of observed phenomena, drawing basic conclusions
- is able to use logical and creative thinking, but is able to choose the correct procedure for preparing solutions, to carry out the individual steps of a reaction according to the procedure
- can describe and evaluate the observed phenomenon and interpret it correctly.

Brief syllabus:

1. Safety at work in the biological laboratory.
2. Working with solutions: checking the correctness of the dosed volume of solution, preparation of solutions.
3. Model organisms: detection of germination of small seeds, extirpation of embryos from seeds, nutrient solution according to Knop
4. Basic approaches to the evaluation of biological material: calculation of the mean value, standard deviation, Gaussian curve, mean error of the mean
5. Plant metabolism: evidence of lignin, tannin reactions, evidence of vitamin C and its properties, evidence of vitamin A, determination of lipid content of the sample
6. Photosynthesis in plants: extraction of lipid dyes and determination of their content, chlorophyll in photosynthesis, determination of total carbohydrate content, evidence of starch in leaves

7. Plant pigments: extraction and separation of photosynthetic pigments, separation of chlorophylls from carotenoids, extraction of anthocyanins and their separation by paper chromatography, chromatography of carotenoids
8. Plant growth and development regulators: determination of gibberellin by biotest, cytokinin biotest
9. Basic constituents of living organisms: determination of ash percentage, evidence of cations, evidence of anions, evidence of phosphates, evidence of hydrogen, oxygen, sulphur, nitrogen and carbon
10. Water: determination of percentage of water and ash in a sample, Traube model of osmotic system, chemical and osmotic lysis, imbibition pressure
11. Proteins: isolation of proteins in native sample, proof reactions of proteins, proof of sulphur in proteins, denaturation and coagulation
12. Carbohydrates: proof reactions, differentiation of different types of carbohydrates, properties of mono- and polysaccharides

Recommended literature:

Shear, A.P. et al. Laboratory manual to accompany"Great experiments in Biology". American University, Washington, USA.
https://dra.american.edu/islandora/object/auislandora%3A33001/datastream/PDF/view
Pollack, R. et al. Lab exercises from biology. John Wiley & Sons, 2021; ISBN 9781119462668.

Language, knowledge of which is necessary to complete the subject: English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: Assoc. Prof. RNDr. Michaela Havrlentová, PhD., RNDr. Barbora Legerská, PhD.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

University of Ss. Cyril and Methodius in Trnava
Námestie Jozefa Herdu 2
917 01 Trnava

SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd324	**Subject name: Laboratory Exercise in Biochemistry**
Type, scope, and method of educational activities: Compulsory subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 5 hours of laboratory exercises per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 5	
Recommended semester/trimester of study: semester 3	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: Completion of all laboratory exercises. At the beginning of the laboratory exercises, the teacher will test the knowledge of the students in the form of a test from the selected part of the laboratory exercises that they will complete in the given lesson. The student must score a minimum of 50% on the laboratory exercises (examples, tests, protocols) in order to register for the examination and pass the course. The student must score at least 50% on the exam in order to receive a final grade, which is the sum of the points earned on the lab exercises and the exam. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: Students • gain theoretical and practical experience with biochemical laboratory techniques commonly used in research work, • learn to master the basic operations necessary for work in a biochemical laboratory.	
Brief content of the subject: 1. Safety of work in the biochemical laboratory. 2. Basic operations in the biochemical laboratory (preparation of buffers, statistical evaluation of measurement results). 3. Carbohydrates (determination of reducing carbohydrates by DNS method). 4. Carbohydrates (determination of sucrose by DNS method). 5. Nucleic acids (isolation of RNA from yeast, determination of RNA) 6. Nucleic acids (isolation of DNA from yeast, determination of DNA) 7. Lipids (determination of free fatty acids, determination of saponification number). 8. Lipids (preparation of lipid fractions from egg yolk). 9. Proteins (determination of proteins by biuret, Lowry and Bradford methods). 10. Enzymes (determination of specific enzyme activity of yeast sucrase/amylase). 11. Enzymes (inhibition of sucrase/amylase). 12. Organic acids (isolation of citric acid from lemon juice).	
Recommended literature: *Bonham, A., Elkins, K.M. Biochemistry laboratory experiments. http://bonhamchemistry.com/wp-content/uploads/2012/01/CHE4350_Lab_Manual_S12.pdf* *Ghafoor, D.D. Biochemistry Lab Manual. https://komar.edu.iq/wp-content/uploads/2018/09/Lab-manual-Biochemistry.pdf*	
Language, knowledge of which is necessary to complete the subject: English	
Subject evaluation	

University of Ss. Cyril and Methodius in Trnava
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917 01 Trnava

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00
Notes:					
Teacher: RNDr. Daniela Ondrejovič Chmelová, PhD.					
Date of last change: 28.02.2022					
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					

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917 01 Trnava

SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd302	**Subject name: Laboratory Exercise in Biology**
Type, scope, and method of educational activities: Compulsory subject. Profile subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 4 hours of laboratory exercises per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 5	
Recommended semester/trimester of study: semester 1	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	

Conditions for completing the subject:

100% attendance at laboratory exercises is essential; in unavoidable cases (health reasons) attendance is excused but conditional on making up the missed laboratory exercise (20 points). Preparation and submission of protocols for the following exercise (20 points) and preparedness for each laboratory exercise, assessed by a short introductory test on the topic to be covered in the laboratory exercise (5 questions), followed by an oral examination and a check of the notes, tables and calculations in the laboratory exercise notebook (50 points), are essential. Successful completion of the course will require a final laboratory exercise in which the student demonstrates independent work towards the correct outcome (a minimum of 6 points out of a maximum of 10 points is required to pass the final laboratory exercise).

Overall evaluation of the course:

A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>;
B - very good (above the average standard but with some errors) = 1.5 <83-91 %>;
C - good (generally sound work with a number of notable errors) = 2 <74-82 %>;
D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>;
E - sufficient (performance meets the minimum criteria) =3 <56-64 %>;
FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>

Educational outcomes:

The student is

- be able to follow the teacher's instructions for safe laboratory work and apply basic knowledge and simple know-how in solving problems under the teacher's supervision
- be able to follow correct procedures for the preparation of solutions
- be able to work correctly with the microscope, perform simple proof reactions and micro- and macroscopic observations according to the procedure
- can describe observed phenomena and interpret simple conclusions under teacher supervision.

Brief content of the subject:

1. Safety at work in the biological laboratory.
2. Fundamentals of microscopy: microscopes - types, construction and maintenance, preparation and observation of native and permanent slides, observation in different optical planes, punching technique.
3. Carbohydrates: preparation of carbohydrate solution, proof of presence of reducing carbohydrates, specific proof reactions in carbohydrate solutions, proof of reducing carbohydrates,
4. Carbohydrates II: evidence of starch, observation of starch grains, observation of amyloplasts, evidence of assimilated starch and evidence of cellulose
5. Proteins: denaturation of proteins, cleavage of disulfide bonds, isolation of proteins from original sources, proof reactions for the presence of proteins in original sources, proof for the presence of sulphur-containing amino acids, reactions for proteins, wheat flour proteins
6. Lipids: staining of fat drops, evidence for the presence of fats in original sources, solubility of lipids, thermal decomposition of vegetable oils, reactions of cholesterol, vulcanisation of oil
7. Nucleic acids: evidence of DNA in the cell nucleus, isolation of DNA from biological material, microscopic observation of phases of mitosis

8. Plant dyes: observation of chloroplasts and plant stomata, division of assimilation dyes, change of chloroplasts into chromoplasts
9. Plant dyes II: anthocyanins as natural pH indicators
10. Biogenic elements: evidence of calcium in plant organism
11. Cell and environment: plasmolysis and deplasmolysis, osmotic value of cell, semipermeability of cell membranes,
12. Plant tissues: plant tissues of different plant species and their parts under microscope,
13. Animal tissues: observation of permanent slides, microscopic observation of human epithelial cells, observation of intestines and organs of earthworms.

Recommended literature:

Shear, A.P. et al. Laboratory manual to accompany"Great experiments in Biology". American University, Washington, USA.
https://dra.american.edu/islandora/object/auislandora%3A33001/datastream/PDF/view
Pollack, R. et al. Lab exercises from biology. John Wiley & Sons, 2021; ISBN 9781119462668.

Language, knowledge of which is necessary to complete the subject: English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: Assoc. Prof. RNDr. Michaela Havrlentová, PhD., RNDr. Barbora Legerská, PhD.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

University of Ss. Cyril and Methodius in Trnava
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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd346	**Subject name: Laboratory Exercise in Enzymology**
Type, scope, and method of educational activities: Compulsory subject. Profile subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 5 hours of laboratory exercises per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 4	
Recommended semester/trimester of study: semester 5	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	

Conditions for completing the subject:

Completion of all laboratory exercises. At the beginning of the laboratory exercises, the teacher will test the knowledge of the students in the form of a test from the selected part of the laboratory exercises that they will complete in the given lesson. The student must score a minimum of 50% on the laboratory exercises (examples, tests, protocols) in order to register for the examination and pass the course. The student must score at least 50% on the exam in order to receive a final grade, which is the sum of the points earned on the lab exercises and the exam.

Overall evaluation of the course:

A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>;
B - very good (above the average standard but with some errors) = 1.5 <83-91 %>;
C - good (generally sound work with a number of notable errors) = 2 <74-82 %>;
D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>;
E - sufficient (performance meets the minimum criteria) =3 <56-64 %>;
FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>

Educational outcomes:

After completing the laboratory exercises in enzymology, the student

- master the common procedures used for the determination of selected enzymes from the six groups of enzymes
- be able to evaluate the influence of various factors on the activity of enzymes and also determine the kinetic parameters
- to try out the basic procedures for working with enzymes

The output of the laboratory exercise will be

- the skill acquired during the semester in working with enzymes and the ability to determine the activity of a selected group of enzymes and to evaluate the influence of selected factors on it
- be able to follow instructions and plan the procedure for carrying out an experiment
- analyse the data obtained
- be able to perform the basic calculations necessary in enzymology in appropriate programs, present their results in an appropriate form and compare them with foreign literature.

Brief content of the subject:

1. Laboratory safety, basic calculations used during laboratory exercises.
2. Oxidoreductases - determination of polyphenoloxidase activity in various plant materials.
3. Transferases - determination of aminotraferase activity,
4. Hydrolases - determination of protease production ability.
5. Lyases - determination of phenylalanine ammonium lyase activity in plant material.
6. Isomerases - determination of glucose isomerase activity.
7. Ligases - determination of glutamine synthetase.
8. Effect of physical factors on the activity of the selected enzyme (pH, temperature).
9. Determination of Michaelis constant of the selected enzyme.
10. Determination of substrate specificity of the selected enzyme,
11. Determination of the inhibition constant for the selected enzyme,
12. Immobilization of the selected enzyme - entrapment in alginate gel,

13. Analysis of polyphenoloxidase isoenzymes by NATIVE-PAGE.					
Recommended literature: *Sadasivam, S., Manickam, A: Biochemical methods. 1991. ISBN 81-2240-976-8.*					
Language, knowledge of which is necessary to complete the subject: English					
Subject evaluation					
A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00
Notes:					
Teacher: RNDr. Daniela Ondrejovič Chmelová, PhD.					
Date of last change: 28.02.2022					
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KCH/bd304	**Subject name: Laboratory Exercise in General Chemistry**
Type, scope, and method of educational activities: Compulsory subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours): 4 hours of laboratory exercises per week** **Study method:** on-site **Study form:** full-time study	
Number of credits: 4	
Recommended semester/trimester of study: semester 1	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: Preparation and full attendacne on laboratory course. Experimantal skill gained during the course and realization of desrcibed works. Laboratory record for each work is requeired. Ranking: 12 short tests before laboratory exercise (each 1 point) 12 laboratory protocols- written record (each 4 points) 2 exams (each 20 points). In total, the student can get 100 points **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: At the successfull end • Student is skilled in basic methods required in inroganic laboratories, simple apparatus construction, manipulation with glassware and chemicals. • Student is able to calculate amount of reagents and yield of products • Student has a knowledge about the application of basic laboratory techniques in practice • Student is skilled in safety and principles of work in a chemical laboratory.	
Brief content of the subject: 1. Safety in the chemical laboratory. Laboratory equipment. Basic physicochemical properties of substances. 2. Glassware. 3. Melting point 4. Boiling point 5. Volatile matter content. 6. Crystallization. 7. Sublimation. 8. Simple distillation. 9. Determination of solubility. 10. Determination of solubility of sparingly soluble compounds. 11. Acidity constant of weak acid. 12. A thermometric titration - determine the concentrations of NaOH	
Recommended literature: *Eric T. Miller, General Chemistry Laboratory Manual: Experiments, Activities, & Exercises. 2020. Kendall Hunt Publishing Company.*	

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C. Rajnák, H. Zárubová, Ľ. Uváčková, R. Boča. Stručná trojjazyčná príručka pojmov pre študentov prírodných vied (1. vyd.) UCM v Trnave, 2020.					
Language, knowledge of which is necessary to complete the subject: English					
Subject evaluation					
A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00
Notes:					
Teacher: doc. RNDr. Cyril Rajnák, PhD. PhD.					
Date of last change: 28.02.2022					
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KCH/bd312	**Subject name: Laboratory Exercise in Inorganic Chemistry**
Type, scope, and method of educational activities: Compulsory subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours): 4 hours of laboratory exercises per week** **Study method:** on-site **Study form:** full-time study	
Number of credits: 4	
Recommended semester/trimester of study: semester 2	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: Preparation and full attendacne on laboratory course. Experimantal skill gained during the course and realization of desrcibed works. Laboratory record for each work is requeired. Ranking: 12 short tests before laboratory exercise (each 1 point) 13 laboratory protocols- written record (each 4 points) 2 exams (each 18 points). In total, the student can get 100 points **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: At the successfull end • Student is skilled in basic methods and synthesis (Acid-base reaction, Precipitation reactions, Evidence of chemical reactions etc.) required in inorganic laboratories, • Student is able to calculate amount of reagents and yield of products • Student has a knowledge about the application of basic laboratory techniques in practice • Student is skilled in safety and principles of work in a chemical laboratory.	
Brief content of the subject: 1. Evidence reactions using different reagents 2. Acid-base reactions. Preparation of K_2SO_4, $KHSO_4$ 3. Acid-base reactions. $NH_4(SO_4)_2$. 4. Preparation of boric acid H_3BO_3 and its properties. 5. Precipitation reactions. Preparation of $BaSO_4$. 6. Precipitation reactions. Preparation of $Al(OH)_3$, $Ni(OH)_3$. 7. Preparation of double salts. Preparation of $AlK(SO)_4.12H_2O$ and $(NH_4)_2Ni(SO_4)_2.6H_2O$ (Tutton´s salts). 8. Oxidation-Reduction Reactions (Redox) reactions. Preparation of hydrogen H_2. 9. Redox reactions. Preparation of Fe_2O_3. 10. Halides. Preparation of compounds in non-aqueous solvent. Preparation of SnI_4. 11. Halides. Preparation of CuCl. 12. Coordination compounds - pentacoordinated $[Ni(H_2O)(NH_3)_4]SO_4$ and hexacoordinated complex $[Ni(NH_3)_6]Cl_2$ 13. Coordination compounds - aminoacetate complexes. Preparation of cis and trans isomers $[Cu(H_2O)(NH_2CH_2COO)_2]$.	

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Recommended literature:

Nath Mala, Inorganic Chemistry: A Laboratory Manual. 2016. 150p. Alpha Science Internationl Ltd.

C. Rajnák, H. Zárubová, Ľ. Uváčková, R. Boča. Stručná trojjazyčná príručka pojmov pre študentov prírodných vied (1. vyd.) UCM v Trnave, 2020.

Language, knowledge of which is necessary to complete the subject: English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: doc. RNDr. Cyril Rajnák, PhD. PhD.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd327	**Subject name: Laboratory Exercise in Microbiology**
Type, scope, and method of educational activities: Compulsory subject. Profile subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 5 hours of laboratory exercises per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 5	
Recommended semester/trimester of study: semester 4	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: Completion of all laboratory exercises. At the beginning of the laboratory exercises, the teacher will test the knowledge of the students in the form of a test from the selected part of the laboratory exercises that they will complete in the given lesson. The student must score a minimum of 50 % on the laboratory exercises (examples, tests, protocols) in order to register for the examination and pass the course. The student must score at least 50 % on the exam in order to receive a final grade, which is the sum of the points earned on the lab exercises and the exam. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: Students • gain theoretical and practical experience in basic microbiological work and use the knowledge gained in further laboratory work with microorganisms and their metabolites • gain a deeper knowledge of prokaryotic and eukaryotic microorganisms • gain experimental experience in microbiology, such as preparation of media, inoculation of microorganisms, monitoring their cultural, morphological and biochemical properties.	
Brief content of the subject: 1. Work safety in the microbiology laboratory. 2. Basic work in the microbiology laboratory (preparation of sterile instruments, solidified and liquid media) 3. Cultivation and morphological characteristics of selected genera of bacteria. 4. Biochemical properties of selected genera of bacteria. 5. Cultivation and morphological characters of selected genera of yeasts. 6. Biochemical characters of selected yeast genera. 7. Cultivation and morphological characters of selected genera of fungi. 8. Biochemical characters of selected genera of fungi. 9. Isolation and enumeration of microorganisms (determination of the appropriate dilution to obtain isolated yeast colonies, direct cell counting in a Bürker chamber, plate dilution method). 10. Isolation and enumeration of micro-organisms (determination of the appropriate dilution to obtain isolated yeast colonies, plate dilution method). 11. Dynamics and growth inhibition of microorganisms (effect of culture conditions on growth of microorganisms, effect of physical factors on growth of *Saccharomyces* yeasts), 12. Dynamics and growth inhibition of microorganisms (antimicrobial efficacy of selected substances, inhibition of bacterial growth by antimicrobial substances).	
Recommended literature:	

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Pollack, R.A., Findlay, L., Mondschein, W., Modesto, R.R. Laboratory exercises in Microbiology. 2020, ISBN 978-1-119-46261-3.					
Language, knowledge of which is necessary to complete the subject: English					
Subject evaluation					
A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00
Notes:					
Teacher: RNDr. Daniela Ondrejovič Chmelová, PhD.					
Date of last change: 28.02.2022					
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd321	**Subject name: Laboratory Exercise in Molecular Biology**
Type, scope, and method of educational activities: Compulsory subject. Profile subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 5 hours of laboratory exercises per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 4	
Recommended semester/trimester of study: semester 3	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	

Conditions for completing the subject:

An essential condition for completing the course is active participation in all laboratory exercises. Each exercise includes a written examination before the exercise, the condition for passing the exercise is a minimum grade E. The evaluation of the exercise is a summary of the classification of theoretical knowledges and practical skills, which declares the degree of independence of the exercise and the subject is to develop your own protocol for each exercise. The final evaluation is a summary of the evaluation of individual exercises, the student's approach, i. degree of its independence, elaboration of protocols from individual exercises and elaboration of a final test for the minimum grade E. Credits will not be awarded to a student who does not achieve a score corresponding to grade E.

Overall evaluation of the course:

A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>;
B - very good (above the average standard but with some errors) = 1.5 <83-91 %>;
C - good (generally sound work with a number of notable errors) = 2 <74-82 %>;
D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>;
E - sufficient (performance meets the minimum criteria) =3 <56-64 %>;
FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>

Educational outcomes:

Within the European Qualifications Framework, students acquire the following skills and abilities by completing the course:

- follow the instructions and plan their own procedure in experimental work, namely - basic laboratory skills for working in a biotechnology laboratory, working with DNA, RNA, protein, recombinant molecules
- students gain the ability to analyze data and present this data as a basis for important decisions in their further experimental practice
- a successful graduate masters all chemical calculations, unit conversions and acquires skills that are a prerequisite for the successful implementation of the experimental part of the bachelor's and later diploma thesis
- the graduate is able to routinely use laboratory tools and correctly masters the principles of laboratory practice
- can use information databases and work with them within the relevant tasks
- knows how to design and carry out an experiment
- can correctly evaluate the achieved results and discuss them with relevant practice, resp. scientific databases
- can draw conclusions and correct procedures with respect to the assigned topic
- the graduate is competitive within peers with respect to the international space

Brief content of the subject:

1. Familiarization of students with safety measures and general provisions when working in a biotechnology laboratory
2. Preparation of solutions and chemical calculations
3. Isolation of plant DNA without the use of commercial kits

4. Isolation of plant DNA through the use of commercial kits
5. Comparison of purity and quality of isolated DNA by appropriate spectrophotometric measurements
6. Integrity check of isolated plant DNA verified by agarose electrophoretic separation. Electrophoretic methods will include agarose gel preparation, electrophoretic separation of nucleic acids in agarose gel.
7. Polymerase chain reaction and its use in routine laboratory practice
8. Basic methods of proteomic research
9. Preparation of protein lysates from different types and kinds of samples
10. Spectrophotometric determination of protein concentration,
11. Electrophoretic separation of proteins in polyacrylamide gel under denaturing conditions in sodium dodecyl sulfate, staining of polyacrylamide gels
12. Transfer of proteins to the membrane -WESTERN BLOT (blotting).

Recommended literature:

Laboratory practice in molecular biology and biotechnologies [electronic] / Daniel Mihálik, Miroslav Glasa ; recenzenti Ľubica Uváčková, Martina Hudcovicová. - 1. vyd. - Trnava : Fakulta prírodných vied, 2021. - 124 s.

Genetically Engineered Cereals for the Production of Polyunsaturated Fatty Acids / Milan Čertík ... [et al.]. In: Food Lipids : chemistry, nutrition, and biotechnology / Casimir C. Akoh. - Boca Raton : Taylor & Francis, 2017. – ISBN 9781498744850. - s. 997-1010.[Spoluautori: Tatiana Klempová - Daniel Mihálik - Katarína Ondreičková - Marcela Gubišová - Ján Kraic]

The Condesed Protocols from Molecular Cloning: A laboratory Manual Sambrook J and RusselD. W Cold Spring harbor Labortatory Press, 2006 Bioinformatics and Functional Genomics, Jonathan Pevsner, http://www.amazon.com/Bioinformatics-Functional-Genomics-Jonathan-Pevsner/dp/0470085851/ref=pd_sim_b_3#reader_0470085851

Language, knowledge of which is necessary to complete the subject: English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: Assoc. Prof. Mgr. Daniel Mihálik, PhD.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KCH/bd329	**Subject name: Laboratory Exercise in Organic Chemistry**
Type, scope, and method of educational activities: Compulsory subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours): 4 hours of laboratory exercises per week** **Study method:** on-site **Study form:** full-time study	
Number of credits: 4	
Recommended semester/trimester of study: semester 4	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: Preparation and full attendacne on laboratory course. Experimantal skill gained during the course and realization of desrcibed works. Laboratory record for each work is requeired. Ranking of one particular course 10 points total assumin 2 points of preparation to laboratory course, 4 points experimental realization and 4 points the written record. Minimum from each lesson is to gain 6 points. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: At the successfull end • student is skilled in basic methods required in laboratories for separation methods, apparatus construction, manipulation with glassware and chemicals. • Student is able to achieve general physico-chemical evaluations of compounds such as melting points, boling points, chromatgraphic factor.	
Brief content of the subject: 1.Laboratory safety. Glassware and apparatus constuction. 2. Separation methods: Crystallization of urea . 3. Separation methods: Distillation of aceton-water mixture. 4. Separation methods: Distillation of aniline under the reduces pressure. 5. Separation methods: Steam distillation of benzaldehyde. 6. Separation methods: Extraction of naphtalene, naphtol and benzoic acid. 7. Separation methods: Thin layer chromatography of 2-nitro and 4-nitro aniline. 8.Physico-chemical characterizations of organic compounds (melting point, Rf, etc.) and sublimation. 9. Synthesis of benzoic acid. Oxidation 10. Synthesis of 2-nitro and 4-nitrophenol. Nitration. 11. Synthesis of bromobutane. Nucleophilic substitution. 12. Synthesis of phenyl and diphenyl urea 13. Conslusions, final remarks and course rating.	
Recommended literature: *Stephánie Caron: Practical synthetic organic chemistry: Reactions, principles and techniques. 2020 John Wiley and Sons, ISBN: 9781119448853 (print) / 9781119448914 (online). DOI: 9781119448914*	
Language, knowledge of which is necessary to complete the subject: English	
Subject evaluation	

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

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Notes:
Teacher: RNDr. Zita Tokárová, PhD.
Date of last change: 28.02.2022
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd348	**Subject name: Laboratory Exercise in Separation Methods**
Type, scope, and method of educational activities: Compulsory subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 5 hours of laboratory exercises per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 5	
Recommended semester/trimester of study: semester 5	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	

Conditions for completing the subject:

Completion of all laboratory exercises. At the beginning of the laboratory exercises, the teacher will test the knowledge of the students in the form of a test from the selected part of the laboratory exercises that they will complete in the given lesson. The student must score a minimum of 50% on the laboratory exercises (examples, tests, protocols) in order to register for the examination and pass the course. The student must score at least 50% on the exam in order to receive a final grade, which is the sum of the points earned on the lab exercises and the exam.

Overall evaluation of the course:

A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>;
B - very good (above the average standard but with some errors) = 1.5 <83-91 %>;
C - good (generally sound work with a number of notable errors) = 2 <74-82 %>;
D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>;
E - sufficient (performance meets the minimum criteria) =3 <56-64 %>;
FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>

Educational outcomes:

In the laboratory exercises

- become familiar with the basic isolation and purification methods used for the isolation of carbohydrates, proteins, lipids, organic acids, terpenoids, alkaloids and polyphenolic substances
- improve their skills in the laboratory
- understand the basic principles of isolation and purification of selected substances.

Brief content of the subject:

1. Basic work in the laboratory
2. Isolation and purification of carbohydrates (isolation of low molecular weight carbohydrates by ethanol extraction)
3. Isolation and purification of carbohydrates (isolation of lactose from milk)
4. Isolation and purification of carbohydrates (isolation of pectins from apple pomace)
5. Isolation and purification of selected proteins and enzymes (isolation and fractionation of casein from milk)
6. Isolation and purification of selected proteins and enzymes (isolation of ovomucoid from egg white)
7. Isolation and purification of selected proteins and enzymes (isolation of amylases from malt)
8. Isolation and purification of lipids (isolation of lipids by Soxhlet extraction)
9. Isolation of organic acids (isolation of citric acid from lemon juice)
10. Isolation of terpenoids (isolation of essential oils from cloves by steam distillation)
11. isolation of alkaloids (isolation of caffeine from tea and purification by sublimation)
12. Isolation of polyphenolic substances (isolation of anthocyanins from fruits).

Recommended literature:

Laboratory manual. https://www.bu.edu/abroad/files/2012/01/lab-manual-madrid-science-program-cas-ch-203.pdf
Deyl, Z. Separation Methods. Elsevier, 1984, eBook ISBN: 9780080860664.

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Seidman, L.A., Moore, C.J., Mowery, J.: Basic Laboratory Methods for Biotechnology. 3rd Edition. 2022, ISBN 9780367244880.					
Language, knowledge of which is necessary to complete the subject: English					
Subject evaluation					
A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00
Notes:					
Teacher: RNDr. Daniela Ondrejovič Chmelová, PhD.					
Date of last change: 28.02.2022					
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd349	**Subject name: Methods and Techniques of Gene Manipulation**
Type, scope, and method of educational activities: Compulsory subject. Profile subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 2 hours of lectures per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 3	
Recommended semester/trimester of study: semester 5	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: Successful completion of the course is conditioned by examination of knowledge in the form of 2 tests during the semester, while both written tests must be assessed by a minimum grade E. The final evaluation of knowledge will be verified by an oral exam. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: Graduates will gain the following knowledge: • - can define recombinant DNA, theoretically be able to prepare it and use it in their future laboratory practice • achieve an advanced level of knowledges, approaches, methodologies and knowledge of DNA cloning, gene manipulation at all levels of organisms • can define terms, has an overview of the use of molecular - biological knowledge in the field of methods and techniques and gene manipulation • can explain and make correct use of the acquired knowledge and relevant procedures in gene manipulation • can choose the right and simplest procedures to achieve the right result • can confront its procedures and subsequently its findings in accordance with scientific databases dealing with relevant issues The graduate will achieve the competence to create a hypothesis, design an experiment and implement an experiment in the field of gene manipulation • can confront the acquired knowledge with different groups of experts • can criticize the situation • acquires responsibility in the use of its knowledge in the right direction • by completing the course, the graduate gains the independence to communicate in the relevant professional sphere • the graduate is able to withstand and manage the onslaught in stressful situations in a way acceptable to the general public • the graduate is able to think about his own actions	
Brief content of the subject: 1. Familiarization of participants with the basic equipment in the laboratory of gene manipulations, 2. Recombinant DNA - definition, Escherichia coli - characteristics and use in gen. manipulations, brief description of E. coli attack by bakeriophage (3 variants), RM system, briefly restriction endonucleases (types I-IV)	

3. Introduction to genes. manipulations - basic dogma, molecular biology, structure of nucleic acids, types of nucleic acids, organization of genes - eukaryotic, prokaryotic,
4. Gene expression, brief description of transcription, translation, description of genetic code, explanation of the term codon usage, posttranslational modifications
5. Plasmids - E.coli as a tool for the gene. manipulations, forms of plasmid DNA, basic characteristics of plasmid, explanation of the term "high-copy plasmids", division of plasmids - conjugative, non-conjugative, types (groups of plasmids), replication of plasmid DNA - briefly, plasmid compatibility (incompatibility), characteristics of plasmid as vector, plasmids such as synthetic vectors, selection markers, description of plasmid pBR322, description of a series of plasmids pUC, what is a multiclonal site ?, blue-white selection - α-complementation, expression plasmids, explanation of the term shuttle vector.
6. Bacterial infection - bacteriophage λ, characteristics of bacteriophage, life cycle of bacteriophage λ, characterization of DNA of bacteriophage λ, description of lytic and lysogenic state of bacteriophage λ. Vectors derived from bacteriophage λ, cosmids, artificial chromosomes, transformation, transfection, other forms of genetic information transfer.
7. Enzymes used in molecular biology in genetic manipulation, restriction endonucleases - characteristics (type I-IV), detailed description of type II enzymes, RE nomenclature, examples of type II RE, types of RE cleavage, DNA modifying enzymes their distribution and description of their activity and use in gene manipulation, examples - nucleases, polymerases, ligases, terminal transferases, phosphatases, kinases
8. Polymerase chain reaction, general characteristics of polymerases, phases of DNA synthesis, description of originality thermostable polymerase, description of PCR phases and components, PCR instrumentation, primer design (description of dimer), multiplex PCR characteristics, Hot Start DNA polymerase PCR, High- fidelity PCR (High Precision PCR), Nested PCR, Asymmetric PCR, Assembly PCR, Touch down PCR, Site directed mutagenesis PCR, TA cloning, cloning of PCR products other than TA cloning, RT - PCR - combination of reverse transcription and PCR, in situ PCR, PCR-RACE, detection of PCR products Real time PCR, Recombinant libraries
9. Polymerase chain reaction, general characteristics, real time PCR (RT-PCR, qPCR) - description of characteristics, use, principles of real time PCR detection, difference between individual principles, real time PCR - sequence of steps, difference between classical PCR and real time PCR, recombinant DNA libraries - basic types and their description, characteristics and description of genomic library and cDNA library, cloning and screening of recombinant libraries, restriction mapping, fragment detection.
10. Hybridization techniques - hybridization of DNA, RNA, DNA probes, RNA probes, types of probe labeling, examples of probe labeling, radioactive and non-radioactive labeling, Southern hybridization, principle description, use, types of transfers, Northern hybridization, description and use, colony blotting, in situ hybridization characterization, western blotting - description, explanation of the principle, detection of immunocomplexes
11. DNA sequencing - description and explanation of the principle for Sanger sequencing, description and characteristics of sequencing according to the Maxam-Gilbert method, product detection, sequencing automation, comparison of sequencing methods.
12. Genetic transformation of eukaryotes and preparation of transgenic eukaryotes.

Recommended literature:

Genetically Engineered Cereals for the Production of Polyunsaturated Fatty Acids / Milan Čertík ... [et al.]. In: Food Lipids : chemistry, nutrition, and biotechnology / Casimir C. Akoh. - Boca Raton : Taylor & Francis, 2017. – ISBN 9781498744850. - s. 997-1010.[Spoluautori: Tatiana Klempová - Daniel Mihálik - Katarína Ondreičková - Marcela Gubišová - Ján Kraic]

Nicholl, D.S.T. (2008): An Introduction to Genetic Engineering, ISBN -11:978-0-511-39858-2, Cambridge University Press.

Linacre, A.M.T. and Tobe, S.T.(2013): Wildlife DNA Analysis, Application in Forensic Science, ISBN-978-0-470-66596-1, Wiley and Sons.

Language, knowledge of which is necessary to complete the subject: English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: Assoc. Prof. Mgr. Daniel Mihálik, PhD.

University of Ss. Cyril and Methodius in Trnava
Námestie Jozefa Herdu 2
917 01 Trnava

Date of last change: 28.02.2022
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

University of Ss. Cyril and Methodius in Trnava
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917 01 Trnava

SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd330	**Subject name: Microbial Biotechnology**
Type, scope, and method of educational activities: Compulsory subject. Profile subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 2 hours of lectures per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 3	
Recommended semester/trimester of study: semester 4	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: Students' academic performance will be tested during the semester with three midterm tests and a final exam, and only students who score at least 50% on the midterm tests will be allowed to take the exam. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: Upon successful completion of the course, the student • can describe the principles of the process and set-up of the basic parts of biotechnological production • describe the production of selected biotechnological products in industrial practice, which are prepared with the active participation of microorganisms, with emphasis on the food and pharmaceutical industries.	
Brief content of the subject: 1. Historical overview of the development of biotechnology and related disciplines that shape the current state of microbial biotechnology 2. Basic aspects of design, optimization and control of fermentation processes (up-stream, main-stream, down-stream) 3. Food applications - beer and malt, 4. Food applications - wine, 5. Food applications - Yeast and spirits, 6. Organic acids (acetic, lactic, propionic and others) 7. Pharmaceutical-chemical applications - antibiotics and vitamins, 8. Pharmaceutical-chemical applications - dyes and biopolymers, 9. Pharmaceutical chemical applications - fats and flavours, 10. Microbial biotransformations as a tool for the preparation of specific substances in bioorganic chemistry 11. Liquid and gaseous biofuels (biogas, hydrogen, ethanol, acetone, butanol) 12. Production of biocatalysts for industrial purposes	
Recommended literature: *Harzevili, F.D., Chen, H.: Microbial Biotechnology. CRC Press, 2015, ISBN 9781138748699.* *Shukla, P.: Microbial Biotechnology. An Interdisciplinary Approach. CRC Press, 2017, ISBN 9780367574130.*	
Language, knowledge of which is necessary to complete the subject: English	
Subject evaluation	

A	B	C	D	E	FX

0.00	0.00	0.00	0.00	0.00	0.00
Notes:					
Teacher: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					
Date of last change: 28.02.2022					
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					

University of Ss. Cyril and Methodius in Trnava
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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KB/bd350	**Subject name: Molecular Biology Databases**
Type, scope, and method of educational activities: Compulsory subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours): 1 hour of lecture and 1 hour of seminar per week** **Study method:** on-site **Study form:** full-time study	
Number of credits: 3	
Recommended semester/trimester of study: semester 5	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	

Conditions for completing the subject:

Participation in teaching in accordance with the UCM Study Regulations in Trnava. Elaboration of practical tasks during the semester according to the assignment. Successful completion of 2 tests during the semester; obtaining more than 50% of the points being considered mandatory. The definitive evaluation of the course is performed by an oral exam.

Overall evaluation of the course:

A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>;
B - very good (above the average standard but with some errors) = 1.5 <83-91 %>;
C - good (generally sound work with a number of notable errors) = 2 <74-82 %>;
D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>;
E - sufficient (performance meets the minimum criteria) =3 <56-64 %>;
FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>

Educational outcomes:

Upon successful completion of the course, the student:

- (i) receives the basic knowledge of the main molecular-biology databases depositing the primary structures of genes and proteins;
- (ii) acquires the practical abilities to work with these databases;
- (iii) is able to retrieve sequence data of proteins, process the data into a relevant sequence alignment and calculate a phylogenetic tree; and
- (iv) is learned to interpret the obtained results in term of proteins active-site, conserved sequence regions in their primary structure and their evolution.

Brief content of the subject:

1. Genes, genomes, genome sequencing projects, proteins, structure of proteins, amino acids forming the proteins, three-letter and one-letter codes for 20 amino acids and peptide bond.
2. Information web-portals: (i) NCBI (Entrez) – National Center for Biotechnology Information (Bethesda, MD, USA) – centre of information databases in USA with respect to biotechnology; and (ii) EBI – European Bioinformatics Institute (Hinxton, Cambridge, UK) – centre of molecular-biology databases, servers and services in Europe with respect to bioinformatics.
3. The two main molecular-biology databases: (i) nucleotide sequence databases GenBank (USA), ENA (European Nucleotide Archive – formerly EMBL Nucleotide Database; Europe) and DDBJ (DNA Data Bank of Japan; Japan); and (ii) amino acid sequence database UniProt (SwissProt and TrEMBL; EBI, Europe).
4. Illustrating example on how to perform a basic bioinformatics analysis of a sample of protein sequences. Retrieving amino acid sequences from sequence databases, making the sequence alignment(s), gaps in the alignment, consensus length, sequence identity, sequence similarity, calculating evolutionary trees. Using the software tools at EBI – programmes Clustal-Omega and Simple Phylogeny.
5. Illustrating example on how to perform a basic bioinformatics analysis of a sample of protein sequences. Retrieving amino acid sequences from sequence databases, making the sequence alignment(s), gaps in the alignment, consensus length, sequence identity, sequence similarity,

calculating evolutionary trees. Using the software tools at EBI – programmes Clustal-Omega and Simple Phylogeny. Semestral test No. 1.

6. Practical example I. A simple bioinformatics analysis of a group of proteins exhibiting a high sequence similarity and representing a single enzyme specificity – the member of a well-conserved biochemical pathway – with focus on a taxonomy; sequences being originating from all the three domains of life – Bacteria, Archaea and Eucarya).
7. Practical example I. A simple bioinformatics analysis of a group of proteins exhibiting a high sequence similarity and representing a single enzyme specificity – the member of a well-conserved biochemical pathway – with focus on a taxonomy; sequences being originating from all the three domains of life – Bacteria, Archaea and Eucarya).
8. Practical example II. An insightful bioinformatics analysis of groups of proteins exhibiting individually a sequence similarity and representing more enzyme specificities that catalyze the respective steps in the same well-conserved biochemical pathway – with focus on both: (i) taxonomy – sequences in each group originate from the same organisms covering all the three domains of life (Bacteria, Archaea and Eucarya); and (ii) evolution of the individual enzyme specificities – in each particular enzyme group and also all together.
9. Practical example II. An insightful bioinformatics analysis of groups of proteins exhibiting individually a sequence similarity and representing more enzyme specificities that catalyze the respective steps in the same well-conserved biochemical pathway – with focus on both: (i) taxonomy – sequences in each group originate from the same organisms covering all the three domains of life (Bacteria, Archaea and Eucarya); and (ii) evolution of the individual enzyme specificities – in each particular enzyme group and also all together.
10. Practical example III. A sophisticated bioinformatics analysis of a family of enzymes sharing, in general, a limited but still relevant sequence similarity that reflects their homology. The analysis includes the in silico translation of a nucleotide sequence into the respective amino acid sequence using the established bioinformatics web-tools. This analysis emphasizes the existence of unique features just within conserved sequence regions characteristic of the studied enzyme family.
11. Practical example III. A sophisticated bioinformatics analysis of a family of enzymes sharing, in general, a limited but still relevant sequence similarity that reflects their homology. The analysis includes the in silico translation of a nucleotide sequence into the respective amino acid sequence using the established bioinformatics web-tools. This analysis emphasizes the existence of unique features just within conserved sequence regions characteristic of the studied enzyme family.
12. Summarizing the content of the course with focus on achieved theoretical knowledge and practical skills of students. Semestral test No. 2.

Recommended literature:

Current and former database issues of the journal Nucleic Acids Research (the so-called Database Issues). Selected articles from the scientific journal literature on the subject.

Language, knowledge of which is necessary to complete the subject: English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: Prof. Ing. Štefan Janeček, DrSc.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

University of Ss. Cyril and Methodius in Trnava
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917 01 Trnava

SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KCH/bd328	**Subject name: Organic Chemistry**
Type, scope, and method of educational activities: Compulsory subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours): 2 hours of lectures and 1 hour of seminar** **Study method:** on-site **Study form:** full-time study	
Number of credits: 4	
Recommended semester/trimester of study: semester 4	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: Participation in lectures and seminars. Successful completion of a written examination during the semester (25 points) and an oral exam in the examination period. To be admitted to the oral exam, the student must write a written examination for min. 51% points. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: Upon successful completion of the course, the student • masters the nomenclature of organic compounds, • can explain the terms chemical bonding, isomerism, tautomerism, bonding, • knows the principles of electronic effects, • is able to independently solve and design methods for the synthesis of organic compounds from the simplest alkanes to selected five- and six-membered heterocycles.	
Brief content of the subject: 1. Subject of organic chemistry, basic terms: chemical structure, and bonding, polarity and polarizability, hybridization, structure of organic compounds, 2. electron effects, saturated hydrocarbons - substitution radical reactions, 3. unsaturated hydrocarbons,reactions: addition, radical, electrophilic, 4. aromatic hydrocarbons, electrophilic substitution reactions, 5. halogen derivatives, chirality, substitution nucleophilic reactions, elimination reactions, 6. hydroxy derivatives, acidity and alkalinity of organic compounds, 7. ethers, organic sulfur compounds, 8. organic nitrogen Mc Murry Jiny preparation and properties of carbonyl compounds reaction, nucleophilic additions, substituted carbonyl compounds, 9. carboxylic acids and their functional derivatives substituted carboxylic acids and their derivatives, 10. heterocyclic compounds: five-membered heterocycles with one heteroatom, six-membered heterocycles, 11. biologically important organic compounds: proteins, carbohydrates, lipids, nucleic acids.	
Recommended literature: *Mc Murry J.: Organic Chemistry.* *Organic Chemistry 2nd Edition. by J. Clayden , N.Greeves , S. Warren. Published 2001 by Oxford University press, 1187 pages, ISBN 978-0199270293*	
Language, knowledge of which is necessary to complete the subject: English	

Subject evaluation					
A	B	C	D	E	FX

0.00	0.00	0.00	0.00	0.00	0.00
Notes:					
Teacher: doc. Mgr. Renáta Gašparová, PhD.					
Date of last change: 28.02.2022					
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					

University of Ss. Cyril and Methodius in Trnava
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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd320	**Subject name: Principles of Molecular Biology**
Type, scope, and method of educational activities: Compulsory subject. Profile subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 2 hours of lectures per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 3	
Recommended semester/trimester of study: semester 3	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	

Conditions for completing the subject:

A necessary condition for passing the course is to achieve evaluation by oral exam at the minimum level of evaluation E. The basic evaluation criterion will be the assessment of the level of knowledge and knowledge based on the exam conducted in the form of an oral discussion between the assessor (teacher) and student. Topics that will be the subject of the exam will be drawn or assigned to the examiner. 100% attendance at lectures is recommended.

Overall evaluation of the course:

A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>;
B - very good (above the average standard but with some errors) = 1.5 <83-91 %>;
C - good (generally sound work with a number of notable errors) = 2 <74-82 %>;
D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>;
E - sufficient (performance meets the minimum criteria) =3 <56-64 %>;
FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>

Educational outcomes:

The graduate of the course will gain knowledge and insights from the basic molecular - biological principles used in the field of research carried out in the natural sciences and will be able to competently apply them in their further experimental activities and practice.

Graduates will gain the following knowledge:

- can define the basic principles of molecular - biological knowledge, theoretically can use them in their future laboratory practice
- achieve an advanced level of knowledge in the field of molecular - biological knowledge, approaches, methodologies and events taking place at all levels of organisms
- can define terms, has an overview of the use of molecular - biological knowledge in
- can explain and correctly use the knowledge gained from molecular biology
- can choose the right and simplest procedures to achieve the right result
- can confront its procedures and subsequently its findings in accordance with scientific databases dealing with relevant issues

The graduate will achieve the competence to create a hypothesis, experiment design and implementation of an experiment in the field of molecular biological research

- can confront the acquired knowledge with different groups of experts
- can criticize the situation
- acquires responsibility in the use of its knowledge in the right direction
- by completing the course, the graduate gains the independence to communicate in the relevant professional sphere
- the graduate is able to withstand and manage the onslaught in stressful situations in a way acceptable to the general public
- the graduate is able to think about his own actions

Brief content of the subject:

1. Basic characterization of prokaryotic and eukaryotic cell genomes - physical and chemical structure of DNA and RNA structure.
2. Brief description of chromosomes, chromain and nucleosomes.

3. DNA replication of prokaryotic and eukaryotic cells, DNA replication of linear and circular DNA molecules,
4. DNA polymerases, straight and lagging strand replication, Okazaki fragments, origin of replication structure, mutations and DNA repair.
5. Operons - Lactose operon - (negative and positive control of lac-operon, catabolic repression, practical use of knowledge about lac-operon)
6.Genome expression - transcription,
7.RNA splicing, organization of promoters, interaction of RNA polymerase and promoter. 8.Regulation of prokaryotic, eukaryotic cell gene expression. Small RNAs and their role in the regulation of gene expression
9.Translation - composition of the translation apparatus, description of individual phases of translation in prokaryotic and eukaryotic cells, structure of ribosomes, characterization of genetic code.
10. Extrachromosomal DNA - description and characteristics.
11. Basic techniques used in molecular - biological research, model organisms.
12. Basic knowledge of gene manipulations

Recommended literature:

Molecular Biology of the Gene, 7th Edition, James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, Richard Losick, 2014 , ISBN-13:9780321762436, elektronická kniha:ISBN-13: 9780321896704

Genetically Engineered Cereals for the Production of Polyunsaturated Fatty Acids / Milan Čertík ... [et al.]. In: Food Lipids : chemistry, nutrition, and biotechnology / Casimir C. Akoh. - Boca Raton : Taylor & Francis, 2017. – ISBN 9781498744850. - s. 997-1010.[Spoluautori: Tatiana Klempová - Daniel Mihálik - Katarína Ondreičková - Marcela Gubišová - Ján Kraic]

Nicholl, D.S.T. (2008): An Introduction to Genetic Engineering, ISBN -11:978-0-511-39858-2, Cambridge University Press.

Language, knowledge of which is necessary to complete the subject: English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: Assoc. Prof. Mgr. Daniel Mihálik, PhD.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

University of Ss. Cyril and Methodius in Trnava
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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KOJP/bd307	**Subject name: Professional Communication in English I**
Type, scope, and method of educational activities: Compulsory subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours): 2 hours of seminars per week** **Study method:** on-site **Study form:** full-time study	
Number of credits: 2	
Recommended semester/trimester of study: semester 1	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: The student is evaluated on the basis of the portfolio he / she creates from the outputs during the semester and defends at the final colloquium. Interim outputs (seminar work) form part of the final evaluation in the range of 30%. Passing the final written test 30%. Project presentation 40%. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: The student • acquires basic communication skills necessary for the target professional environment, develops general and professional vocabulary, techniques of written expression and independent oral expression (presentation) • acquires grammatical, syntactic and phraseological peculiarities of professional genres, develops the lexicon of the target environment, works with specialized dictionaries • can deal with professional lexicon in describing subjects and phenomena related to the chosen study discipline • can work with authentic text • can interpret a professional topic in an oral presentation.	
Brief content of the subject: 1. Introduction to the subject. Studying at university. 2. Introduction to presentation techniques and presentation language. 3. Communication and technical principles of effective professional presentation with the support of PPT. 4. From alchemy to modern natural sciences. Historical development of natural sciences with emphasis on biotechnology. 5. Important personalities, discoveries and theories. 6. Development of professional lexicon. Overview and definition of applied scientific disciplines - biochemistry, environmental chemistry, pharmaceutical chemistry, analytical chemistry, biotechnology, etc. 7. Biotechnology laboratory. Laboratory instruments, devices and equipment - their description, function and use. Types of definitions, writing definitions. 8. Health and safety at work in the laboratory. Safety regulations when working with chemical and biological substances. Imperative to express activities and instructions. 9. Signs, symbols and terms used to indicate safety hazards in laboratories and public buildings. 10. Work procedure description, laboratory experiment. Laboratory documentation, laboratory protocol. Active and passive verb constructions.	

11. Writing the final test.
12. Final colloquium and presentation of the selected topic.

Recommended literature:

Miština J. et al. 2012. English for Professional Communication Development. Bratislava: STU v Bratislave, 2006. 150 s. ISBN 80-227-2420-3.

Chauhan Prashant, 2015: English for Biotechnology. LAP Lambert Academic Publishing. 104 pg. ISBN-10: 365967155X, ISBN-13: 978-3659671555

Fran Zimmerman, 1989: English for Science. Pearson College Div; 1st edition. 186 pg. ISBN-10: 0132821796, ISBN-13: 978-0132821797

Ivor Williams, 2007: English for Science and Engineering. National Geographic Learning - Professional English, ISBN: 9781413020533

A.R. Bolitho, 1997: Study English for Science. Longman. 104 pg. ISBN-10: 0582552486, ISBN-13: 978-0582552487

Language, knowledge of which is necessary to complete the subject: English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: Assoc. Prof. PaedDr. Juraj Miština, PhD.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

University of Ss. Cyril and Methodius in Trnava
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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KOJP/bd315	**Subject name: Professional Communication in English II**
Type, scope, and method of educational activities: Compulsory subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours): 2 hours of seminars** **Study method:** on-site **Study form:** full-time study	
Number of credits: 2	
Recommended semester/trimester of study: semester 2	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: The student is evaluated on the basis of the portfolio he / she creates from the outputs during the semester and defends at the final colloquium. Interim outputs (seminar work) form part of the final evaluation in the range of 30%. Passing the final written test 30%. Project presentation 40%. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: The student • can define and distinguish genres of professional communication • they will acquire grammatical, syntactic, phraseological peculiarities of genres, they will expand the lexicon of the target environment and they will learn to deal with professional translation and interpretation dictionaries • can interpret graphs, diagrams, schemes, tables, pictograms and technical symbols • can work with authentic professional text • enrich general and professional vocabulary with synonyms, homonyms, antonyms, neologisms, internationalisms, multiword names, composites, etc., which he uses in creating his own speeches • recognizes the morphematic structure of the word and the principles of word formation in the English language • expand verbal and nonverbal communication competencies in the field of presentations.	
Brief content of the subject: 1. Introduction to the subject. Characteristics of the scientific field - biotechnology. Term paper assignment. 2. Types of specialized dictionaries (print, electronic, online). Specifics of working with explanatory and translation specialized dictionaries. 3. Graphical expression of data - graphs, diagrams, schemes, tables. Reading information from graphs and tables. 4. Verbal interpretation of graphs - expressing developments, trends, changes and proportions. Practical application of professional lexicon. 5. Atoms and molecules - the chemical basis of life. Differences between living and inanimate nature. 6. Periodic table of chemical elements. Chemical properties of substances. 7. Organic and inorganic chemistry - nomenclature of chemical compounds, IUPAC nomenclature. Reading chemical formulas and equations.	

8. Cell - the basic building block of living organisms. Animal and plant cell - classification, composition, differences. Use of professional lexicon.
9. Viruses and bacteria, microscope composition, types of microscopes.
10. Fungi and molds, history of microscopy, modern microscopy.
11. Writing the final test.
12. Final colloquium and presentation of the selected topic.

Recommended literature:

Miština J. et al. 2012. English for Professional Communication Development. Bratislava: STU v Bratislave, 2006. 150 s. ISBN 80-227-2420-3.

Chauhan Prashant, 2015: English for Biotechnology. LAP Lambert Academic Publishing. 104 pg. ISBN-10: 365967155X, ISBN-13: 978-3659671555

Fran Zimmerman, 1989: English for Science. Pearson College Div; 1st edition. 186 pg. ISBN-10: 0132821796, ISBN-13: 978-0132821797

Ivor Williams, 2007: English for Science and Engineering. National Geographic Learning - Professional English, ISBN: 9781413020533

A.R. Bolitho, 1997: Study English for Science. Longman. 104 pg. ISBN-10: 0582552486, ISBN-13: 978-0582552487

Language, knowledge of which is necessary to complete the subject: English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: Assoc. Prof. PaedDr. Juraj Miština, PhD.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

University of Ss. Cyril and Methodius in Trnava
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917 01 Trnava

SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd354	**Subject name: Regulation and Biosafety of Biotechnology**
Type, scope, and method of educational activities: Compulsory subject. Profile subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 2 hours of lectures per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 3	
Recommended semester/trimester of study: semester 6	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: Attendance at the lectures. Successful completion of the final (oral) exam. During the semester, the student takes 1 preliminary test. To take the exam, the student must obtain at least 51% of points from the preliminary test. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: Upon successful completion of the course, the student • understand and gain knowledge of biotechnology from a biosafety perspective and of regulatory frameworks at national and international level, • will be able to assess, analyse, address and implement risk management of current biotechnologies.	
Brief content of the subject: 1. Biodiversity and its importance for humans, the use of biodiversity for human needs 2. Causes of loss of diversity, ecological footprint, carbon footprint 3. Convention on Biological Diversity; NATURA 2000; AGENDA 2030; Cartagena Protocol; Nagoya Protocol 4. Methods of genetic material transfer 5. Biological risk; biological factors and risk groups 6. Laboratories for risk groups 7. Risk assessment, risk evaluation and risk analysis 8. Genetically modified organisms GMOs 9. Contained use of GMOs and deliberate release of GMOs 10. EU regulatory system; GMO authorization process in the EU; cultivation of GM plants in the EU 11. ISAAA GM crop database; mandatory and voluntary labeling of GM crops in Slovakia and in the world; socio-economic, cultural and environmental impacts of GMOs 12. New biotechnological approaches (genome editing using site-specific nucleases and recombinases, pollen sterility) and their legislative regulation.	
Recommended literature: *Thayyil, N. (2014). "Risk, science and society". In* Biotechnology Regulation and GMOs: Law, *Technology and Public Contestations in Europe. Cheltenham, UK: Edward Elgar Publishing. doi: https://doi.org/10.4337/9781783473885.00011* *John Thomas J. , Fuchs R. (2002) Biotechnology and Safety Assessment. eBook ISBN: 9780080528182*	
Language, knowledge of which is necessary to complete the subject: English	

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Subject evaluation					
A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00
Notes:					
Teacher: Assoc. prof. Ing. Jana Moravčíková, PhD.					
Date of last change: 28.02.2022					
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd331	**Subject name: Semester Project**
Type, scope, and method of educational activities: Compulsory subject. **Subject type (C, CO, O):** C **Recommended scope of teaching (in hours):** 2 hours of seminars per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 4	
Recommended semester/trimester of study: semester 4	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: During the semester, students' independent work on the assignment will be assessed as a prerequisite for taking the exam. At the end of the semester, the final thesis will be evaluated, the level of use of relevant literary sources, their processing and use, and the final presentation of the thesis will be evaluated. This will be assessed by a committee of members of the department and will be graded A-Fx. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: The aim of the course is • the development of the student's intellectual and creative abilities and practical skills, • the development and consolidation of the habits of methodological discipline in the treatment of a scientific topic. The student has • demonstrate the ability to independently use the theoretical knowledge acquired by studying at university, • apply them in solving specific tasks, • demonstrate the ability to present the work, • knowledge and defend the obtained results.	
Brief content of the subject: 1. Literature search in appropriate scientific databases. 2. Working with literature, proper citation. 3. Evaluating summaries of literature data and knowledge, in 4. Use and interpretation of the information obtained, 5. Intermediate and final editing of the text. 6. Principles of proper presentation, 7. Preparation of a power point presentation, 8. Interpretation of the work. 9. Discussion after the presentation, understanding of the topic. 10. - 12. Student presentations.	
Recommended literature: *Books, journals and other literature according to the topic of the project.*	
Language, knowledge of which is necessary to complete the subject: English	
Subject evaluation	

A	B	C	D	E	FX

0.00	0.00	0.00	0.00	0.00	0.00
Notes:					
Teacher: Assoc. Prof. RNDr. Michaela Havrlentová, PhD.; RNDr. Barbora Legerská, PhD.					
Date of last change: 28.02.2022					
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava

Faculty/institute: Faculty of Natural Sciences

Subject code: KCH/bd347 | **Subject name:** Separation Methods

Type, scope, and method of educational activities: Compulsory subject.
Subject type (C, CO, O): C
Recommended scope of teaching (in hours): 2 hours of lectures and 1 hour of seminar
Study method: on-site
Study form: full-time study

Number of credits: 3

Recommended semester/trimester of study: semester 5

Level of study: bachelor

Prerequisite subjects: without prerequisite subjects

Conditions for completing the subject:

During the semester, as part of the seminars, students present selected foreign publications that relate to the latest areas of substance separation with an emphasis on identification. For each presentation, the student can get a maximum of 50 points. Credits will be awarded to students who have obtained at least 100 points. After obtaining the required number of points, students will take an oral exam.

Overall evaluation of the course:

A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>;
B - very good (above the average standard but with some errors) = 1.5 <83-91 %>;
C - good (generally sound work with a number of notable errors) = 2 <74-82 %>;
D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>;
E - sufficient (performance meets the minimum criteria) =3 <56-64 %>;
FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>

Educational outcomes:

Upon successful completion of the course, the student:

- knows the requirements for proper sampling of heterogeneous samples and with the basic methods of analytical chemistry in analysis, especially in the field of trace and ultra-trace analysis with a focus on toxic, carcinogenic substances
- can use individual analytical methods to identify substances and synthesize individual knowledge gained by various analytical methods
- knows analytical methods for reducing the limit of determination and detection with emphasis on the selectivity of separation systems
- is able to assess the current possibilities of analytical chemistry and realistically use them in trace analyses of substances in various samples.

Brief content of the subject:

1. Introduction, sampling of emissions, wastewater, solid waste, use of statistical methods, international standards.
2. Sample preparation for analysis, extraction, adsorption.
3. Trace and ultra-trace analysis in analytical chemistry, pre-concentration techniques and sample preparation methods.
4. Separation methods, their importance in the analysis of different samples with different matrices.
5. Detection techniques in trace and ultra-trace analysis.
6. Optical and electrochemical detectors and their principles.
7. Use of diode array detectors, their use in the identification of substances in trace concentrations, indirect detection.
8. MS and NMR, basics, use of these methods in identification in connection with separation techniques.
9. Importance of derivatization in determination and identification of substances.
10. Multidimensional separation techniques, combination of detection techniques,
11. Obtaining orthogonal information for identification, the importance of analytical methods.
12. Reporting of results, statistical evaluation of measurement, validation of the method.

Recommended literature:

University of Ss. Cyril and Methodius in Trnava
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Labuda J. et al.: Analytical Chemistry. STU Bratislava, 2019
Štulík K. et al.: Analytical Separation Methods. UK Prague, 2004.

Language, knowledge of which is necessary to complete the subject: English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: Assoc. Prof. Ing. Andrea Purdešová, PhD.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd351	**Subject name: Theory and Methodology of Bachelor Thesis**

Type, scope, and method of educational activities: Compulsory subject.
Subject type (C, CO, O): C
Recommended scope of teaching (in hours): 8 hours of seminars per week
Study method: on-site
Study form: full-time study

Number of credits: 5

Recommended semester/trimester of study: semester 5

Level of study: bachelor

Prerequisite subjects: without prerequisite subjects

Conditions for completing the subject:
During the semester, students' individual work with the literature will be evaluated, which is a prerequisite for passing the exam. At the end of the semester, the elaboration of the final semestral work will be evaluated. Evaluated will be the level of use of relevant literary sources, the processing and utilization of the sources, level of processing and final presentation of the work. The final presentation will be assessed at commission consisting of members of the Department. The work will consist of at least 10 pages of the text as an introduction of the Bachelor Thesis and 15 relevant citations.
Overall evaluation of the course:
A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>;
B - very good (above the average standard but with some errors) = 1.5 <83-91 %>;
C - good (generally sound work with a number of notable errors) = 2 <74-82 %>;
D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>;
E - sufficient (performance meets the minimum criteria) =3 <56-64 %>;
FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>

Educational outcomes:

- Students will demonstrate their knowledge and skills in obtaining literature from primary and secondary sources and to write a scientific text.
- Students will also show their basic knowledge and orientation in the topic of the work.

Brief content of the subject:
Introduction to the issue according to the type of project. Literature searching in relevant databases on the Internet, literary processing, goal definition and experiments planning, selection of methods. Preparation of experiments, evaluation of partial results, defining conclusions. Project elaboration and power point presentation.

Recommended literature:
Bui Y.N.: How to write a masters thesis, SAGE Publications, Inc; 3rd edition (July 31, 2019), 320 pp., ISBN-13: 978-1506336091
Brian Paltridge, Sue Starfield: Thesis and Dissertation Writing in a Second Language A Handbook for Students and their Supervisors. Routledge, Australia. 2019, 248 pp., ISBN 9781138048706

Language, knowledge of which is necessary to complete the subject: English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: Assoc. Prof. RNDr. Michaela Havrlentová, PhD.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

University of Ss. Cyril and Methodius in Trnava
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Compulsory optional subjects

University of Ss. Cyril and Methodius in Trnava
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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd337	**Subject name: Animal Biology**
Type, scope, and method of educational activities: Compulsory optional subject. **Subject type (C, CO, O):** CO **Recommended scope of teaching (in hours):** 2 hours of lectures per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 2	
Recommended semester/trimester of study: semester 4	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	

Conditions for completing the subject:

During the semester (in the 7th and the 12th week of the semester) two tests will take place, both for 10 points. It is mandatory for the student to obtain at least 50% of points from each of the tests. The final evaluation of the course is a written (3 questions) followed by an oral exam.

Overall evaluation of the course:

A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>;
B - very good (above the average standard but with some errors) = 1.5 <83-91 %>;
C - good (generally sound work with a number of notable errors) = 2 <74-82 %>;
D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>;
E - sufficient (performance meets the minimum criteria) =3 <56-64 %>;
FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>

Educational outcomes:

The student

- achieves basic knowledge about the organization and functions of the animal cell and on the phylogeny of animal tissues, organs, and organ systems in individual groups of animals,
- the student also understands the basic patterns of functioning of animal organisms at the single- and multicellular levels at different phylogenetic levels.

Brief content of the subject:

1. Introduction to the issue, history of biological sciences of animals, evolution and classification of animals.
2. Basics of the cell: structure, function, organization, differences between plant and animal cell.
3. Ontogenetic development of animals (embryogenesis and postnatal growth) - gametogenesis, fertilization, blastula, gastrula, neurulation, organogenesis.
4. Hox genes. Organization of the animal organism.
5. Animal cells, tissues - shapes and types of cells, characteristics of animal cells, epithelial cell, neuron, muscle cell.
6. Organ systems - basic anatomy and phylogeny - skeleton, locomotor system, nervous system, hormonal system, circulatory system, respiratory system.
7. Regulation of the internal environment - cellular communication and cellular connections, transmembrane proteins, signalling, cellular receptors.
8. Digestion of animals - forms of nutrients, phylogeny, herbivores, carnivores, monogastres, polygastres, digestion of poultry.
9. Animal reproduction - asexual, sexual, hermaphroditism, sex determination, karyotype, sperm, egg - morphology, formation, fertilization, pheromones, sexual dimorphism.
10. Excretion of animals, types of substances, phylogeny of the excretory system, osmoregulation, regulation of renal function.
11. Animal diversity - genetic polymorphism, biodiversity, morphological polymorphism, mutations, C paradox, eukaryotic genome.
12. Domestication of animals, breeding.

Recommended literature:

University of Ss. Cyril and Methodius in Trnava
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917 01 Trnava

Urry L., Cain M., Wasserman S., Minorsky P., Orr R.: Campbell Biology. Pearson Education 2021, 1504 pp. ISBN-13: 9780135988046 *Victoria Aspinall, Melanie Cappello: Introduction to Animal and Veterinary Anatomy and Physiology. Bell and Brain Ltd. CABI Glasgow 2019, 304 pp. ISBN-10: 1789241154*					
Language, knowledge of which is necessary to complete the subject: Slovak, English					
Subject evaluation					
A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00
Notes:					
Teacher: Assoc. Prof. RNDr. Michaela Havrlentová, PhD.					
Date of last change: 28.02.2022					
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KAI/bd341	**Subject name: Basic Statistics**
Type, scope, and method of educational activities: Compulsory optional subject. **Subject type (C, CO, O):** CO **Recommended scope of teaching (in hours): 2 hours of lectures and 2 hours of seminars** **Study method:** on-site **Study form:** full-time study	
Number of credits: 2	
Recommended semester/trimester of study: semester 4	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	

Conditions for completing the subject:

As part of the continuous assessment, there will be one written examination from which the student can obtain 40b. There will be a written part in 60b at the exam. In total, the student can get 100 points.

Overall evaluation of the course:

A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>;
B - very good (above the average standard but with some errors) = 1.5 <83-91 %>;
C - good (generally sound work with a number of notable errors) = 2 <74-82 %>;
D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>;
E - sufficient (performance meets the minimum criteria) =3 <56-64 %>;
FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>

Educational outcomes:

The student

- knows the methods of obtaining data processing obtained by mass surveys,
- obtained by measuring a certain feature,
- can analyze a statistical set of mainly one-dimensional variables using statistical methods suitable for the study of technical and scientific processes,
- can examine the influence of factors on the processes, express the dependence between phenomena, verify assumptions and estimate the characteristics of the observed processes.

Brief content of the subject:

Lectures and subsequent exercises will take place according to the following syllabus:
Course contents:
1. Probability theory, basic concepts, probability calculation of simple phenomena, analytical methods for calculating the probability of complex phenomena.
2. Random variable, distribution of random variables, ways of describing the probabilistic behavior of random variables.
3. Description of random variables using quantitative characteristics, characteristics expressing the level of a random variable, variability characteristics, skewness and spike characteristics, moment characteristics.
4. Models of theoretical distributions of one-dimensional random variables, models of distributions of discrete variables (binomial, hypergeometric, Poisson distribution).
5. Models of distributions of continuous variables (normal distribution, Student's, Snedecor's distribution).
6. Sampling methods, the essence of sampling methods, basic set, sampling set, distributions of sampling characteristics, properties of sampling characteristics.
7. Determining the characteristics of the base set, point estimation, interval estimation, confidence interval for the mean, confidence interval for variance, binomial distribution parameter estimation.
8. The task of determining the scope of the sample, determining the scope of selection from the normally distributed base file, determining the scope of selection in binomial distribution.

9. Hypothesis testing, testing procedure, division of tests.
10. Testing of means, testing of variances, testing the significance of the difference between means, testing of pair values.
11. Testing of abundance as a whole, parametric tests of good agreement, nonparametric tests, tests of independence, tests of extreme deviations.
12. Analysis of variance, nature and types of problems, one-factor uniform complex.
13. Correlation analysis, types of problems in correlation analysis, regression problem, correlation problem, simple linear correlation.

Recommended literature:

An Introduction to Statistical learning : with applications in R / Gareth James ... [et al.]. - New York : Springer, 2013. - xiv, 426 p. ; 24 cm. - (Springer Texts in Statistics). - ISBN 978-1-4614-7137-0.
Statistics / James T. McClave, Frank H. Dietrich. - 4. vyd. - San Francisco : Dellen Publishing Company, 1998. - xx, 1014 s. ; 24 cm. - ISBN 0-02-379260-4.

Language, knowledge of which is necessary to complete the subject: Slovak, English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: Assoc. Prof. RNDr. Iveta Dirgová Luptáková, PhD.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd363	**Subject name: Biophysical Chemistry II**
Type, scope, and method of educational activities: Compulsory optional subject. **Subject type (C, CO, O):** CO **Recommended scope of teaching (in hours):** 2 hours of lectures and 2 hours of seminars per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 2	
Recommended semester/trimester of study: semester 5	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	

Conditions for completing the subject:

The examination is based on obtaining at least 50% of the points in the examples during the semester. The continuous assessment consists of mid-term and end-of-semester papers. The points obtained during the semester are counted towards the overall grade in the exam (maximum 30 points). The examination is written and consists of a test with 10 short 2-point questions and a part with five 10-point questions. The number of points required for the test is 10 and a minimum of 5 points for each 10-point question.

Overall evaluation of the course:

A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>;
B - very good (above the average standard but with some errors) = 1.5 <83-91 %>;
C - good (generally sound work with a number of notable errors) = 2 <74-82 %>;
D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>;
E - sufficient (performance meets the minimum criteria) =3 <56-64 %>;
FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>

Educational outcomes:

Student

- gains basic knowledge of chemical equilibria in electrochemical systems
- can describe and explain the conduction of electricity in electrolytes and the generation of electric potential at electrodes and electromotive voltage in galvanic cells
- acquire knowledge of the application of electrochemical cells in practice
- know how to describe and interpret the rates and kinetics of simple and complex chemical reactions, and understand the fundamentals of chemical kinetics theories
- master the basic knowledge of colloid chemistry, especially colloidal systems and phase interface processes
- The acquired knowledge can be used in practice e.g. in the field of fuel cells, batteries, sensors, in solving chemical reaction mechanisms in the field of organic synthesis, pharmaceutics and biochemical processes.

Brief content of the subject:

1. Conductivity of electrolyte solutions, mobility and molar conductivity of ions, conversion numbers and methods of their determination, electrolysis, Faraday's laws
2. Activity and concentration of ions, activity coefficient, standard states in electrochemistry, Debye-Hückel law.
3. Equilibria in electrolyte solutions - weak acids and bases, Ostwald's dilution law, hydrolysis, heterogeneous equilibria, buffer solutions.
4. Galvanic cells, electromotive voltage, Nernst equation.
5. Electrodes of the 1st kind, electrodes of the 2nd kind, redox electrodes, concentration cells.
6. Thermodynamics of galvanic cells, oxygen-hydrogen fuel cell.
7. Reaction rate, chemical reaction rate, rate equations, reaction order and molecularity.
8. 1st and 2nd order reactions, half-life of reaction, nth order reactions, methods of determining the order of reaction.
9. Complex reactions - counter reactions, parallel reactions, sequential reactions.

10. Theory of chemical kinetics - Arrhenius equation, Eyring's theory of absolute reaction rates.
11. Catalysis and kinetics of homogeneous catalysis, enzyme catalysis.
12. Colloid-disperse systems, distribution functions, free and total surface energy.
13. Adsorption isotherms, wetting, spreading coefficient.

Recommended literature:

P.W. Atkins, Physical Chemistry. Oxford, 6th edition 1998; slovenský preklad: Fyzikálna chémia, STU, Bratislava, 1999.

Language, knowledge of which is necessary to complete the subject: Slovak, English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: Prof. Mgr. Alžbeta Marček Chorvátová, DrSc.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

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917 01 Trnava

SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KER/bd360	**Subject name: Environmental Monitoring and Bioindicators**
Type, scope, and method of educational activities: Compulsory optional subject. **Subject type (C, CO, O):** CO **Recommended scope of teaching (in hours): 2 hours of lectures per week** **Study method:** on-site **Study form:** full-time study	
Number of credits: 2	
Recommended semester/trimester of study: semester 5	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	

Conditions for completing the subject:

The acquired knowledge and competences of the students will be tested during the semester by 2 intermediate tests, while only students who achieve a minimum of 50% of the points from these intermediate tests will be admitted to the final exam.

Overall evaluation of the course:

A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>;
B - very good (above the average standard but with some errors) = 1.5 <83-91 %>;
C - good (generally sound work with a number of notable errors) = 2 <74-82 %>;
D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>;
E - sufficient (performance meets the minimum criteria) =3 <56-64 %>;
FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>

Educational outcomes:

Upon successful completion of this course, the student will gain:

- knowledge of the current state of the art in monitoring abiotic and biotic components of the environment, including monitoring methods and monitoring systems;
- knowledge and competence on the use of bioindicators in the study area;
- knowledge of the dynamics of ecological systems.

Brief content of the subject:

1. asic concepts and definitions of environmental monitoring.
2. Partial monitoring system of the air. Imission and emission sampling of air pollutants and particle size separation of aerosol fractions.
3. Partial monitoring system of the water.
4. Methods and principles for evaluation of analytical results based on comparison of results with permissible pollution limits.
5. Partial monitoring system of the soil.
6. Partial monitoring system of the geological factors.
7. Partial monitoring system of the wastes.
8. Partial monitoring system of the environmental radioactivity.
9. Partial monitoring system of biotic components of the environment: plants, animals and micro-organisms. Partial monitoring system of the forests.
10. Partial monitoring system of the contaminants in the environment, food and feed.
11. Bioindication and the use of bioindicators in environmental pollution monitoring.
12. Monitoring of hazardous elements, limit values. Environmental information systems.

Recommended literature:

KIM, Y. – PLATT, U. 2008. Advanced Environmental Monitoring. Springer, 2008. 420 s. ISBN 978-1-4020-6364-0.

WIERSMA, B.G. 2004. Environmental Monitoring. Boca Raton: CRC Press, 2004. 792 s. ISBN 978-15-66706-41-4.

Language, knowledge of which is necessary to complete the subject: Slovak, English

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Subject evaluation					
A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00
Notes:					
Teacher: Assoc. doc. RNDr. Miroslav Horník, PhD.					
Date of last change: 28.02.2022					
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KER/bd333	**Subject name: Environmental Toxicology**
Type, scope, and method of educational activities: Compulsory optional subject. **Subject type (C, CO, O):** CO **Recommended scope of teaching (in hours): 2 hours of lectures and 1 hour of seminar per week** **Study method:** on-site **Study form:** full-time study	
Number of credits: 2	
Recommended semester/trimester of study: semester 3	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: The acquired knowledge and competences of the students will be tested during the semester by 2 intermediate tests and they will prepare a semester presentation on the given topic, while only students who achieve at least 50 % of the points from these intermediate tests and the defense of the semester presentation will be admitted to the final exam. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: Upon successful completion of this course, the student will gain: • knowledge of toxicology and ecotoxicology; • knowledge and competence in defining sources of toxic substances and environmental contaminants, their impacts on individual biological systems and human health; • ability to explain the relationship between the structure and toxicity of a substance; • knowledge of chemical interactions, genotoxicity and the fate of substances in organisms.	
Brief content of the subject: 1. Introduction to the course of toxicology, basic definitions and concepts. 2. Risk properties of substances in terms of toxicology and ecotoxicology, sources and distribution of substances. 3. Toxicity assessment, exposure and effects of toxic substances. 4. Factors influencing the toxicity of substances. 5. Interaction of hazardous substances with living organisms. 6. Fate of substances in the organism - toxicodynamics, bioconcentration. 7. Transformation reactions of substances in the environment and in organisms. 8. Relationship between structure, physicochemical properties and toxicity. 9. Principles of toxicological tests. 10. Hazardous substances and legislation, new trends in risk reduction of chemical substances. 11. Methods of removal hazardous toxic substances from the environment - remediation (remediation) methods, technology of wastewater treatment plants. 12. Student presentations on given topics related to selected hazardous toxic substances.	
Recommended literature: *DONG, M.H. 2014. An Introduction to Environmental Toxicology. CreateSpace Independent Publishing Platform, 2014. 500 s. ISBN 978-14-94324-08-7.*	

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KLAASSEN, C.D. 2008. Toxicology – The basic science of poisons. New York : McGraw-Hill Companies, Inc., 2008. 1309 s. ISBN 0-07-147051-4.					
Language, knowledge of which is necessary to complete the subject: Slovak, English					
Subject evaluation					
A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00
Notes:					
Teacher: Assoc. doc. RNDr. Miroslav Horník, PhD.					
Date of last change: 28.02.2022					
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KB/bd357	**Subject name: Evolutionary Biology**
Type, scope, and method of educational activities: Compulsory optional subject. **Subject type (C, CO, O):** CO **Recommended scope of teaching (in hours): 2 hours of lectures and 1 hour of seminar per week** **Study method:** on-site **Study form:** full-time study	
Number of credits: 2	
Recommended semester/trimester of study: semester 5	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	

Conditions for completing the subject:

i) Participation in teaching in accordance with the UCM Study Regulations in Trnava;
ii) Preparation and presentation (powerpoint) of a current topic in the field of evolutionary biology;
iii) Active participation in seminars, asking questions about presentations, discussion (consideration in the overall evaluation of the course);
iv) Written exam (4 questions).

Overall evaluation of the course:

A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>;
B - very good (above the average standard but with some errors) = 1.5 <83-91 %>;
C - good (generally sound work with a number of notable errors) = 2 <74-82 %>;
D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>;
E - sufficient (performance meets the minimum criteria) =3 <56-64 %>;
FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>

Educational outcomes:

Upon successful completion of the course, the student will

- gain an overview of hypotheses and theories about biological evolution with emphasis on the latest knowledge and opinions in this field, with an emphasis on genetic and molecular aspects of evolutionary processes
- acquire knowledge about the origin and evolution of the eukaryotic cell, about current scientific ideas about the origin of life, genetics of the population as a basis for evolutionary theory; mutations, selection, gene duplication and genetic drift as evolutionary factors, micro- and macro-evolution.

Brief content of the subject:

1. Evolution as a biological phenomenon. Evolutionary hypotheses before Darwin. Lamarck and his Theory of evolution. Lamarkism and Heredity of Acquired traits. Weismann's barrier and the "Central dogma of molecular biology". Evidence of evolution;
2. Darwin and his theory of evolution. Neodarwinism – a synthesis of Darwinism with Mendelian genetics. Dawkins hypothesis of the "Selfish gene". Evolutionary strategies: K-selection and r-selection. Evolution in a stable environment; the "Red queen" hypothesis;
3. Mutations and selection as evolutionary factors; mutation adaptability. Delbrück-Luria Fluctuation test. Natural and Sexual selection. Evolutionary advantage of Recombination and Sex. The role of chance in evolution;
4. Population genetics as a basis for evolutionary theory. Biological variability. Genetic polymorphism – stable and transient. Basic population-genetic selection models;
5. Genetic drift as an evolutionary factor. Haldane's "Evolutionary paradox" and its solution. Kimura's theory of Neutral evolution. Selectionaly Neutral mutations;
6. Molecular evolution – principles of studying the evolution of organisms at the molecular level; Molecular clock; morphology *versus* molecules; Living fossils; basic principles and methods of Molecular systematics and Molecular ecology;

7. Gene duplication as an evolutionary factor. The emergence of Evolutionary Novelties. Macromutations. Mechanisms of Gene duplication. Microevolution and Macroevolution. Mechanisms of Species Origin. Reproductive Isolation mechanisms; emergence of new species of organisms – Speciation;
8. Primary classification of organisms – genesis; three lines/Domains of life: Archaea, Bacteria, Eukarya – starting points, methodological principles; Ribosomal RNAs and their genes as Molecular chronometers; Universal Phylogenetic Tree; comparative studies of individual genes *versus* Comparative genomics;
9. Origin and evolution of the Eukaryotic cell. Hypotheses about the origin of the Eukaryotic cell. Eukaryotic cell as a chimera. Endosymbiotic theory. Mitochondria and Chloroplasts – descendants of originally independent bacteria;
10. Evolution of notation of genetic information. The genome architecture of archaeons, bacteria and eukaryotes. Continuity *versus* discontinuity of notation (exons and introns). Genome size, C value paradox. Pseudogens. Coordinated evolution – Molecular drive, Concerted evolution. Horizontal gene transfer. Genetic code – the question of universality. RNA editing;
11. Origin of life - current hypotheses and how to verify them: (i) How did the basic monomers of which Nucleic acids and Proteins are formed? (ii) How were Proteins and Nucleic acids formed from the relevant monomers (Amino acids, Nucleotides) without the aid of enzyme catalysis? the role of Coacervates, proteinaceous Microspheres, Liposomes; (iii) How did the ability to Self-replication develop? RNA world; Catalytically active RNA – Ribozymes. Extremophilic organisms;
12. Analysis of Phylogeny and construction of Dendrograms. Schools and approaches (Phylogenetics, Phenetics, Cladistics). Molecular Phylogeny of selected taxa. Evolution of *Homo sapiens* in the light of Molecular genetics;
13. Critique and Defense of Evolutionary theories. The Magical Islands – a natural history documentary about the Galapagos Archipelago (video – camera and directed by Miroslav Šebesta).

Recommended literature:

Futuyma D.J.: Evolution (Third Edition), Sinauer Associates, Inc. Publishers Sunderland, Massachusetts U.S.A. 2013.

Futuyma D.J., Kirkpatrick M.: Evolution (4th Edition), 594 Pages, Published 2017 by Sinauer Associates Is An Imprint Of Oxford University Press; ISBN-13: 978-1-60535-605-1, ISBN: 1-60535-605-0

Language, knowledge of which is necessary to complete the subject: Slovak, English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: prof. RNDr. Juraj Krajčovič, CSc.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KB/bd358	**Subject name: General Virology**
Type, scope, and method of educational activities: Compulsory optional subject. **Subject type (C, CO, O):** CO **Recommended scope of teaching (in hours): 2 hours of lectures and 1 hour of seminar** **Study method:** on-site **Study form:** full-time study	
Number of credits: 2	
Recommended semester/trimester of study: semester 5	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	

Conditions for completing the subject:

1) Attendance at lectures in accordance with the Study Regulations of the UCM in Trnava;
2) Preparation, processing of scientific literature and presentation of theme (by PowerPoint) within the virology topics;
3) Active participation in seminars, asking questions about presentations, discussion (taking into account in the overall evaluation of the course),
4) Written exam (test + open questions).

Overall evaluation of the course:

A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>;
B - very good (above the average standard but with some errors) = 1.5 <83-91 %>;
C - good (generally sound work with a number of notable errors) = 2 <74-82 %>;
D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>;
E - sufficient (performance meets the minimum criteria) =3 <56-64 %>;
FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>

Educational outcomes:

After successful completion of the course, the student:

- will acquire knowledge about replication, taxonomy, pathogenesis, and epidemiology of plant and animal viruses, and methods of their detection
- will get information about the issue of viruses infecting fungi, insects, bacteria, protozoa, and archaeons
- will gain orientation in the basic classification, pathogenesis, and ecology of these specific groups of viruses, including the characteristics of subviral agents (viroids, viroids)
- will get acquainted with the possibilities of biotechnological applications of viruses and bacteriophages and their use in therapy.

Brief content of the subject:

1. Veterinary virology. Significant families, genera, and species of viruses causing viruses in animals. Pathogenesis and control of zoonotic and veterinary viral diseases.
2. Plant viruses. Introduction to the issue. Symptomatology and manifestation of viral infection in plants. Mechanisms of plant virus transmission. Taxonomy of plant viruses.
3. Pathogenesis of plant viral diseases. Replication of plant viruses. Virus-host cell interaction. Genome of plant viruses. Virus-virus interactions. Evolutionary processes.
4. Epidemiology and ecology of plant viruses. An overview of the most economically important families and genera of plant viruses.
5. Viroids and viroids. Viroid genome. Taxonomic division. Economically important viroids and their epidemiology.
6. Laboratory diagnostics of plant viruses and viroids. Biological methods. Microscopic methods. Immunochemical methods. Molecular methods.
7. Insect viruses and their taxonomy. Insect-virus interactions. Ecology of insect viruses.
8. Fungal viruses (mycoviruses). Fungal-virus interactions (hypovirulence, killer yeast, increased host temperature tolerance), mycovirus taxonomy.

9. Protozoan viruses. Gigantic amoeba viruses (mimiviruses, pandoraviruses, faustoviruses). Virophagus.
10. Bacterial viruses (bacteriophages). Genome and life cycle of bacteriophages (lytic, lysogenic). Bacteriophage taxonomy. Bacteriophage therapy and potential applications of bacteriophages
11. Archeological viruses. Examples of archaeons (hyperthermoarcheons, haloarcheons, methanoarcheons) and their viruses, classification of viruses infecting archaeons, ecology of archaeon viruses.
12. Use of viruses in biotechnology. Viral vectors and examples of their use in therapy. Transient expression of foreign genes in plants.

Recommended literature:

Zimmer C (2015) A Planet of Viruses 2nd ed. The University of Chicago Press. ISBN: 978-0-226-29420-9

Abedon ST (2009) Bacteriophage Ecology. Population Growth, Evolution, and Impact of Bacterial Viruses. Cambridge University Press. ISBN: 978-0-51-154148-3

Language, knowledge of which is necessary to complete the subject: Slovak, English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: Assoc. Prof. RNDr. Milan Seman, CSc.; Ing. Miroslav Glasa, DrSc.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KB/bd332	**Subject name: Genetics**
Type, scope, and method of educational activities: Compulsory optional subject. **Subject type (C, CO, O):** CO **Recommended scope of teaching (in hours): 2 hours of lectures and 1 hour of seminar per week** **Study method:** on-site **Study form:** full-time study	
Number of credits: 2	
Recommended semester/trimester of study: semester 3	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: i) Participation in teaching in accordance with the UCM Study Regulations in Trnava; ii) Preparation and presentation (powerpoint) of a current topic in the field of genetics; iii) Active participation in seminars, asking questions about presentations, discussion (consideration in the overall evaluation of the course); iv) Written exam (4 questions). **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: Upon successful completion of the course, the student will • acquire up-to-date knowledge of genetic processes taking place at various levels of the organization of living systems, from the molecular to the population level; • gain an overview of a wide range of knowledge that will enable him to orient in genetic terminology, understand the principles of heredity and variability of traits and characteristics of organisms; • will be able to apply this knowledge in molecular-biological and biotechnological subjects and understand the principles of application of knowledge from genetics in practice.	
Brief content of the subject: 1. Genetics as a scientific discipline; subject of study, history, basic concepts and terminology; levels of genetic analysis; 2. Mendel and Mendelism – basic concepts and rules; Mendel's experiments. Testing of genetic hypotheses. Pedigree analysis; 3. Chromosomes and Cell cycle; Cytogenetics, chromosome staining techniques; Chromosome inheritance theory. Cell cycle – basic phases of mitotic and meiotic division, checkpoints, recombination and crossing-over; 4. Gonosomal inheritance; Heterochromosomes, Masculine and Feminine factors. Chromosomal sex determination. Sex-linked inheritance. Inheritance of gender-controlled and gender influenced traits. Gonosome abnormalities in structure and numbers; 5. Extranuclear inheritance; Structure and function of Mitochondrial and Chloroplast genomes, their origin and evolution. Inheritance of traits determined by mitochondrial and chloroplast genes – principles and specifics; Uniparental way of organelle inheritance – advantages and disadvantages; Homoplasmy *versus* Heteroplasmy. Plasmids and Symbionts; 6. Genetic code; properties of the Genetic code (universal, triplet, degenerate). Deciphering of the Genetic code. Two forms of the Genetic code – Universal and Operational. RNA editing;	

7. Gene expression and its regulation: Transcription and Translation, Protein transport in cells; Transposons, Horizontal gene transfer mechanisms; Reverse genetics – investigation of biological processes by inhibition of gene expression; Epigenetics;
8. Mutations as a source of genetic variability. Classification of Mutations according to: (i) location, (ii) causes, (iii) extent, (iv) direction of mutagenesis, (v) compatibility with life, (vi) degree of phenotypic expression. Types of Mutagens (physical, chemical, biological), Antimutagens; Detection of mutations (Ames test); DNA Repair mechanisms;
9. Genetic markers and their practical use, Molecular Diagnostics; categorization of DNA Polymorphisms: Microsatellites, Minisatellites, Deletions, Duplications, Inversions, Insertions; DNA fingerprinting. Gene therapy;
10. Population genetics and Heredity of Complex traits (Quantitative Trait Loci); Hardy-Weinberg's law of Population equilibrium; Genetic variability in natural populations; Gene, Genotype and Phenotype frequencies; changes in population gene frequencies: Mutations, Selection, Migration, Genetic Drift (Founder effect); Panmixis, Inbreeding, Homogamy;
11. Genetic basis of Cancer; Tumorigenesis as a result of pathological Cell cycle regulation; sporadic and familial forms of Cancer. Influence of Mutagens and Carcinogens. Characteristics of Cancer cells. Cell transformation into a Cancer cell. Stages of cancer, benign and malignant Tumors. Anticancer therapy;
12. Evolutionary genetics and Comparative genomics. Genes as historical documents, Molecular evolution, Molecular clocks. Gene and genome structure in prokaryotes and eukaryotes; Ancient DNA and its analysis.

Recommended literature:

Snustad, D.P.; Simmons, M.J. (2015). Principles of Genetics, 7th Edition, John Wiley & Sons, Inc.; ISBN: 978-1-119-14228-7.

Language, knowledge of which is necessary to complete the subject: Slovak, English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: prof. RNDr. Juraj Krajčovič, CSc.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KBT/bd	**Subject name: Introduction to Radioecology**
Type, scope, and method of educational activities: Compulsory optional subject. **Subject type (C, CO, O):** CO **Recommended scope of teaching (in hours): 2 hours of lectures and 1 hour of seminar per week** **Study method:** on-site **Study form:** full-time study	
Number of credits: 2	
Recommended semester/trimester of study: semester 3	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: The acquired knowledge, skills and competences of the students will be tested during the semester by 2 intermediate tests, and only students who achieve a minimum of 50 % of the points from these intermediate tests will be admitted to the final exam. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: Upon successful completion of this course, the student will gain: • knowledge of the general principles applicable in nuclear sciences, including the detection of radioactivity; • basic knowledge of the operation of nuclear energy technologies; • knowledge and competence in the origin of contamination of the atmosphere, hydrosphere and pedosphere by sources of ionising radiation, as well as the behaviour of radionuclides in environmental compartments; • competences and partly skills in the determination and monitoring of natural radioactivity or natural radionuclides.	
Brief content of the subject: 1. The nature of radioactivity. γ decay, metastable state and isomeric transition, internal conversion, β- and β+ decay, electron capture, α decay, spontaneous fission, nucleon emission, decay schemes. 2. Natural and artificial radioactivity. Radioactive decay series. 3. Kinetics of radioactive decay. 4. Moving and age radioactive equilibrium, basics of isotope chronology. 5. Interaction of ionizing radiation with matter. 6. Physical, biological and effective half-lives. 7. Classification of radionuclides on the basis of radiotoxicity. 8. Detection of radioactivity, ionization methods, scintillation methods, radiography. 9. Stages in the development of radioecology and the place of radioecology in the system of natural sciences. 10. Anthropogenic environmental radioactivity. Nuclear tests and nuclear power plants. 11. Origin of contamination of the atmosphere, hydrosphere and pedosphere by sources of ionizing radiation. 12. Pathways of radionuclide transfer from source to man.	
Recommended literature:	

ATWOOD, D. 2010. Radionuclides in the environment. New York : Wiley, 2010. 522 s. ISBN 978-0-470-71434-8.
CHOPPIN, G. – LILJENZIN, J.-O. – RYDBERG, J. – EKBERG, C. 2013. Radiochemistry and nuclear chemistry. 4th Edition. New York : Elsevier, Academic Press, 2013. 866 s. ISBN 978-0-12-405897-2.

Language, knowledge of which is necessary to complete the subject: Slovak, English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: Assoc. Prof. RNDr. Miroslav Horník, PhD.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KAI/bd335	**Subject name: Mathematics**
Type, scope, and method of educational activities: Compulsory optional subject. **Subject type (C, CO, O):** CO **Recommended scope of teaching (in hours): 2 hours of lectures and 2 hours of seminars** **Study method:** on-site **Study form:** full-time study	
Number of credits: 2	
Recommended semester/trimester of study: semester 3	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: As part of the continuous assessment, there will be one written examination from which the student can obtain 40b. There will be a written part in 60b at the exam. In total, the student can get 100 points. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: The student will • understand the mathematical foundations necessary for a student of science, • understand the basic concepts of vector calculus, linear and matrix algebra, mathematical analysis, • be able to apply them in solving more complex problems, • obtain the necessary equipment for further study in the field.	
Brief content of the subject: Lectures and subsequent exercises will take place according to the following syllabus: 1. Vector, vector operations, scalar, vector, mixed product of vectors. Applications of product products (scalar, vector, mixed). Linear dependence, independence of vectors. 2. Matrices, operations with matrices, inverse matrix, determinant of matrices. 3. Systems of linear algebraic equations - solution methods: Cramer's rule, inverse matrix. Gaussian elimination method. 4. Real function of real variable, field of definition of basic property. 5. Elementary functions. 6. Sequence, sequence limits, function limits, continuity of functions. 7. Derivation of a function in a number - definition, geometric and physical meaning. 8. Derivation of a function - definition, derivation of elementary functions, basic rules for derivation of a function. 9. Derivatives of higher orders, differential functions. 10. Use of derivation in the investigation of the properties of a function - monotonicity, extremes. 11. Use of derivation in the investigation of the properties of a function - concavity, convexity, inflection point of a function. 12. The course of the function.	
Recommended literature: *Basic Mathematics for Chemists / Peter Tebbutt. - Second Edition. - New York : John Wiley and SONS, 1998. - 275 p. ; 24 cm. - ISBN 0-471-97284-3.*	

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Mathematics education in Europe : commom challenges and national policies. - Brussels : Education, Audiovisual and Culture Executive Agency, 2011. - 180 p. ; 30 cm. - ISBN 978-92-9201-221-2.					
Language, knowledge of which is necessary to complete the subject: Slovak, English					
Subject evaluation					
A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00
Notes:					
Teacher: Assoc. Prof. RNDr. Iveta Dirgová Luptáková, PhD.					
Date of last change: 28.02.2022					
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KCH/bd361	**Subject name: Natural Drugs**
Type, scope, and method of educational activities: Compulsory optional subject. **Subject type (C, CO, O):** CO **Recommended scope of teaching (in hours): 2 hours of lectures and 1 hour of seminar** **Study method:** on-site **Study form:** full-time study	
Number of credits: 2	
Recommended semester/trimester of study: semester 5	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: Participation in lectures and seminars. One semester work presented on a topic assigned by the teacher. Successful completion of the exam during the exam period. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: Upon successful completion of the subject, the student: • has an overview of natural substances as medicines, • masters the basics of pharmacognosy, • understands the issue of finding new biologically active natural molecules	
Brief content of the subject: 1. Historical development of natural remedies. 2. Herbal drugs: antivirals, antiprotozoals. 3. Herbal drugs: phytoestrogens, antihyperglycemics. 4. Herbal drugs: vitamins, polyphenols. 5. Herbal remedies: natural sweet taste substances, Tea Tree Oil, Reishi and others. 6. Herbal substances in the prevention and therapy of Alzheimer's disease. 7. Herbal substances in cancer prevention and therapy. 8. Herbal substances in the prevention and therapy of other diseases of civilization. 9. Animal products as drugs: omega-3 fatty acids, bee products (propolis, honey), the use of snake venom and other animal poisons. 10. Probiotics, prebiotics. 11. Register and clinical trial of phytopharmaceuticals and newly registered phytopharmaceuticals. 12. Phytopharmaceuticals vs. nutritional supplements.	
Recommended literature: Drugs of Natural Origin. A Treatise of Pharmacognosy, Seventh Edition. By G. Samuelsson, L. Bohlin. Published 2017 by Swedish Pharmaceutical Press, 808 Pages. ISBN 9789198094251.	
Language, knowledge of which is necessary to complete the subject: Slovak, English	

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:
Teacher: Assoc. Prof. Mgr. Renáta Gašparová, PhD.
Date of last change: 28.02.2022
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

University of Ss. Cyril and Methodius in Trnava
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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KCH/bd362	**Subject name: Organic Chemistry II**
Type, scope, and method of educational activities: Compulsory optional subject. **Subject type (C, CO, O):** CO **Recommended scope of teaching (in hours):** 2 hours of lectures and 2 hours of seminars per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 2	
Recommended semester/trimester of study: semester 5	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: Participation in lectures and exercises. Successful completion of two examinations during the semester (25 points each) and an oral examination in the exam period. To be admitted to the oral exam, the student must write each examination with a minimum of 51% points. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: Upon successful completion of the course, the student will: - knows organic chemistry from carbonyl compounds to selected natural substances - their preparation and characteristic reactions - is able to independently solve and design methods of their synthesis.	
Brief content of the subject: 1. Carbonyl compounds preparation and properties of carbonyl compounds reactions, nucleophilic addition, 2. side chain reactions, substituted carbonyl compounds, 3. quinoid compounds, 4. carboxylic acids, 5. functional derivatives of carboxylic acids, 6.substituted carboxylic acids and their derivatives, 7. organic compounds of phosphorus, arsenic, silicon and boron, 8. derivatives of carbonic acid, 9. heterocyclic compounds: five-membered heterocycles with one heteroatom, 10. benzoderivatives of 5-membered heterocycles, azoles, 11. six-membered heterocycles, 12. condensed and polycondensed heterocycles, 13. biologically important organic compounds: proteins, carbohydrates, lipids, nucleic acids.	
Recommended literature: *McMahon, P.E., Khomtchouk, B.B., Wahlesteadt, C: Survival Guide to Organic Chemistry. Bridging the Gap from General Chemistry, 2016, CRC Press, ISBN 9781498777070.* *Smith, M.B. Organic Chemistry. An Acid-Base Approach, Second Edition, 2nd Edition, 2016, CRC Press, ISBN 9781138624474.*	
Language, knowledge of which is necessary to complete the subject: Slovak, English	
Subject evaluation	

A	B	C	D	E	FX

0.00	0.00	0.00	0.00	0.00	0.00
Notes:					
Teacher: Assoc. Prof. Mgr. Renáta Gašparová, PhD.					
Date of last change: 28.02.2022					
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KB/bd339	**Subject name: Plant Physiology**
Type, scope, and method of educational activities: Compulsory optional subject. **Subject type (C, CO, O):** CO **Recommended scope of teaching (in hours): 2 hours of lectures per week** **Study method:** on-site **Study form:** full-time study	
Number of credits: 2	
Recommended semester/trimester of study: semester 4	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	

Conditions for completing the subject:

i) participation in teaching in accordance with the Study Regulations of the UCM in Trnava;
ii) students will write two semester tests during the semester, which will be scored. At the end of the semester an exam will be held. In order to be admitted to the examination, a student must obtain a majority of points in the sum of both semester tests. Credit will not be awarded to a student who receives less than half of the total points and will also not be allowed to sit for the examination.

Overall evaluation of the course:

A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>;
B - very good (above the average standard but with some errors) = 1.5 <83-91 %>;
C - good (generally sound work with a number of notable errors) = 2 <74-82 %>;
D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>;
E - sufficient (performance meets the minimum criteria) =3 <56-64 %>;
FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>

Educational outcomes:

The aim of this subject is

- to provide students with up-to-date information on the basic life processes taking place in plant bodies

After completing the subject

- the student will gain knowledge that will allow him to understand the nature of the mechanisms of plant functioning in a changing environment at the level of physiological and biochemical processes
- student will be able to use this knowledge correctly in practical activities requiring plant cultivation.

Brief content of the subject:

1. Physiological characteristics of plants. Plant kingdom, plant cell and plant tissues.
2.Water regime of the plant: water in the environment of the plant; intake, transport and release of water by the plant.
3.Mineral plant nutrition: nutrients; intake, transport and mechanisms of nutrient assimilation.
4. Photosynthesis: principles and mechanisms of photosynthesis.
5. Plant respiration: glycolysis, lipid metabolism and respiratory regulation.
6.Energy metabolism of plants: energy flow; redox reactions. Enzymes and metabolism.
7.Cell growth and division: cell cycle and its regulation, cell wall, cytokinesis.
8. Growth and developmental processes: seed germination, embryogenesis; meristems; development of stems, leaves and roots; senescence and programmed cell death.
9. Growth regulators - classification, biosynthesis, functions and effects.
10.Response of plants to biotic stress: plant defense mechanisms; secondary metabolites.
11. Plant responses to abiotic stress: mechanisms of response to drought, cold stress, heavy metals and water stress; antioxidants; reactive oxygen species; oxidative stress.
12. Plant movements: vital movements, autonomous movements, reaction movements, orientation movements; effects of gravity.

13. Morphogenetic processes in vitro: principles and molecular mechanisms.					
Recommended literature: *Taiz, L., Zeiger, E.: Plant Physiology. Sinauer Associates, 3rd Ed., 2002, 690 s.; ISBN: 0878938230* *Hopkins, W.G., Huner, N.P.A: Introduction to Plant Physiology. Wiley & Sons, 3rd Ed., 2002, 576 s.; ISBN: 0471389153* *Buchanan B.B, Griussem, W., Jones, R.L.: Biochemistry and molecular biology of plants. Am. Soc. Plant Phys., Rockwille, USA, 2000, 1367 s.; ISBN: 0943088399*					
Language, knowledge of which is necessary to complete the subject: Slovak, English					
Subject evaluation					
A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00
Notes:					
Teacher: Assoc. Prof. RNDr. Ľubica Uváčková, PhD.					
Date of last change: 28.02.2022					
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KOJP/bd336	**Subject name: Professional Communication in English III**
Type, scope, and method of educational activities: Compulsory optional subject. **Subject type (C, CO, O):** CO **Recommended scope of teaching (in hours): 2 hours of seminars per week** **Study method:** on-site **Study form:** full-time study	
Number of credits: 2	
Recommended semester/trimester of study: semester 3	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	

Conditions for completing the subject:

The student is evaluated on the basis of the portfolio he / she creates from the outputs during the semester and defends at the final colloquium. Interim outputs (seminar work) form part of the final evaluation in the range of 30%. Passing the final written test 30%. Project presentation 40%.

Overall evaluation of the course:

A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>;
B - very good (above the average standard but with some errors) = 1.5 <83-91 %>;
C - good (generally sound work with a number of notable errors) = 2 <74-82 %>;
D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>;
E - sufficient (performance meets the minimum criteria) =3 <56-64 %>;
FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>

Educational outcomes:

The student

- will acquire stylistic, grammatical, syntactic-morphological and phraseological peculiarities of professional genres
- they will expand the lexicon of the target environment and learn to deal with translation and interpretation dictionaries
- learn the principles of translation of authentic professional texts
- in the context of thematic areas expands general and professional vocabulary and communication skills in English
- interdisciplinary acquires language resources from related scientific disciplines
- they will learn to interpret numbers, numerals, numerical data and mathematical operations, they will get basic language inputs from several areas of natural sciences
- in presentation techniques, he improves in graphic elements, animations and multimedia processing of the presentation visual.

Brief content of the subject:

1. Introduction to the subject. Characteristics of content blocks. Term paper assignment.
2. Principles and specifics of professional text translation. Work with explanatory and translation specialized dictionaries.
3. Grammatical, syntactic and stylistic means of working with translated text. Work with professional lexicon in translation - creation of terminology. Comparing Slovak and English.
4. English language in natural sciences - mathematics (interpretation of numbers, numerals, numerical data and mathematical operations).
5. English language in natural sciences - physics (physical quantities, reading formulas, physical properties of substances). International System of Units SI. Geometry (one-, two-, three-dimensional shapes and solids).
6. Professional ethics in natural sciences.
7. Professional ethics and moral responsibility - green technologies.

8. Traditional and modern food technologies.
9. Genetics, genetic code, DNA. Genetically modified organisms. Safety of food products.
10. Graphics, animation and multimedia processing of the presentation visual.
11. Writing the final test.
12. Final colloquium and presentation of the selected topic.

Recommended literature:

Miština J. et al. 2012. English for Professional Communication Development. Bratislava: STU v Bratislave, 2006. 150 s. ISBN 80-227-2420-3.

Chauhan Prashant, 2015: English for Biotechnology. LAP Lambert Academic Publishing. 104 pg. ISBN-10: 365967155X, ISBN-13: 978-3659671555

Fran Zimmerman, 1989: English for Science. Pearson College Div; 1st edition. 186 pg. ISBN-10: 0132821796, ISBN-13: 978-0132821797

Ivor Williams, 2007: English for Science and Engineering. National Geographic Learning - Professional English, ISBN: 9781413020533

A.R. Bolitho, 1997: Study English for Science. Longman. 104 pg. ISBN-10: 0582552486, ISBN-13: 978-0582552487

Language, knowledge of which is necessary to complete the subject: Slovak, English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: Assoc. Prof. PaedDr. Juraj Miština, PhD.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KOJP/bd342	**Subject name: Professional Communication in English IV**
Type, scope, and method of educational activities: Compulsory optional subject. **Subject type (C, CO, O):** CO **Recommended scope of teaching (in hours): 2 hours of seminars per week** **Study method:** on-site **Study form:** full-time study	
Number of credits: 2	
Recommended semester/trimester of study: semester 4	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	

Conditions for completing the subject:

The student is evaluated on the basis of the portfolio he / she creates from the outputs during the semester, and defends at the final colloquium. Interim outputs (Europass CV, cover letter) form part of the final evaluation in the range of 10%, semester work (annotation record for professional text), submission of a comprehensive set of materials (English professional text, glossary, translation, annotation) 30%, passing the final written test 30% and project presentation 30%.

Overall evaluation of the course:

A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>;
B - very good (above the average standard but with some errors) = 1.5 <83-91 %>;
C - good (generally sound work with a number of notable errors) = 2 <74-82 %>;
D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>;
E - sufficient (performance meets the minimum criteria) =3 <56-64 %>;
FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>

Educational outcomes:

The student

- will acquire stylistic, grammatical, syntactic-morphological and phraseological peculiarities of written and oral genres in a professional environment (professional CV in Europass format, motivation letter and job interview)
- expand the lexicon of the target environment
- acquires the language skills needed to get a job
- meets important personalities from the field of chosen scientific field and their contribution to scientific knowledge
- in the context of thematic areas expands general and professional vocabulary and communication skills in English
- learn the principles of writing annotations and abstracts
- through his scientific field he builds a positive attitude towards the environment.

Brief content of the subject:

1. Characteristics of content blocks. Term paper assignment.
2. Annotation and abstract writing. Stylistic, grammatical and syntactic-morphological aspects
3. genre. Preparation for the abstract in the year and bachelor thesis.
4. Job search, labor market orientation within the EU.
5. Different forms of resume. Writing your CV in Europass CV format.
6. Writing a cover letter. Written communication in a professional environment (e-mail,
7. internet, internet etiquette).
8. Job interview, principles of professionally correct communication.
9. Global environmental issues. Greenhouse gases, greenhouse effect.
10. Ecology and sustainable development.
11. Environment, healthy lifestyle. Toxic effects of chemicals on
12. human body.
13. Modern biotechnology - red, white and green biotechnology.

14. Trends and future of biotechnology - bioleaching and phytomining.
15. Writing the final test.
16. Final colloquium and presentation of the selected topic.

Recommended literature:

Miština J. et al. 2012. English for Professional Communication Development. Bratislava: STU v Bratislave, 2006. 150 s. ISBN 80-227-2420-3.

Chauhan Prashant, 2015: English for Biotechnology. LAP Lambert Academic Publishing. 104 pg. ISBN-10: 365967155X, ISBN-13: 978-3659671555

Fran Zimmerman, 1989: English for Science. Pearson College Div; 1st edition. 186 pg. ISBN-10: 0132821796, ISBN-13: 978-0132821797

Ivor Williams, 2007: English for Science and Engineering. National Geographic Learning - Professional English, ISBN: 9781413020533

A.R. Bolitho, 1997: Study English for Science. Longman. 104 pg. ISBN-10: 0582552486, ISBN-13: 978-0582552487

Language, knowledge of which is necessary to complete the subject: Slovak, English

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:

Teacher: Assoc. Prof. Juraj Miština, PhD.

Date of last change: 28.02.2022

Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KER/bd338	**Subject name: Renewable Energy**
Type, scope, and method of educational activities: Compulsory optional subject. **Subject type (C, CO, O):** CO **Recommended scope of teaching (in hours): 2 hours of lectures per week** **Study method:** on-site **Study form:** full-time study	
Number of credits: 2	
Recommended semester/trimester of study: semester 4	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	

Conditions for completing the subject:

The following criteria will be evaluated in the course (max 100 points): intermediate written examination: max 40 points; final written and oral examination: max 60 points.

Overall evaluation of the course:

A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>;
B - very good (above the average standard but with some errors) = 1.5 <83-91 %>;
C - good (generally sound work with a number of notable errors) = 2 <74-82 %>;
D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>;
E - sufficient (performance meets the minimum criteria) =3 <56-64 %>;
FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>

Educational outcomes:

Upon successful completion of this course, the student will gain:

- knowledge and competence in the use of renewable energy (RE): hydro and wind energy, direct use of solar energy, biomass, geothermal energy;
- knowledge of technical equipment for RE use, economic, legal and safety aspects, impacts on the environment.

Brief content of the subject:

1. Non-renewable and renewable natural resources, characteristics, overview.
2. Renewable resources as types of energy, global energy problems, energy policy of the Slovak Republic and the EU. Potential for use in the Slovak Republic.
3. Conventional energy production, fossil and nuclear fuels. Current sources and their possible substitutes.
4. The main positives and negatives of the use of conventional fuels.
5. Origin of geothermal energy, overview of technologies for its use.
6. The main positives and negatives of geothermal energy use.
7. Heat pumps.
8. Origin of solar, hydro and wind energy. Basic overview of technologies for their utilisation.
9. Environmental impacts, environmental impact assessment.
10. Biomass - energy crops and organic wastes.
11. Basic overview of technologies for its use.
12. Production and use of liquid and gaseous fuels from biomass (ethanol, methanol, MERO, biogas). The main positives and negatives of biomass use.
13. Energy saving opportunities. Progressive and alternative methods of energy generation and storage.

Recommended literature:

Twidell, J. – Weir, T. 2006. Renewable energy resources. New York : Taylor & Francis, 2006, 601 s. ISBN 0-419-25320-3.

Vieirada Rosa, A. 2005. Fundamentals of renewable energy processes. New York : Elsevier Academic Press, 2005, 689 s. ISBN 978-0-12-088510-7.

Language, knowledge of which is necessary to complete the subject: Slovak, English

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Subject evaluation					
A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00
Notes:					
Teacher: Assoc. Prof. RNDr. Miroslav Horník, PhD., Mgr. Martin Valica, PhD.					
Date of last change: 28.02.2022					
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KER/bd340	**Subject name: Sustainable Development**
Type, scope, and method of educational activities: Compulsory optional subject. **Subject type (C, CO, O):** CO **Recommended scope of teaching (in hours): 2 hours of lectures per week** **Study method:** on-site **Study form:** full-time study	
Number of credits: 2	
Recommended semester/trimester of study: semester 4	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: During the semester, students will elaborate a term presentation on any topic in the context of sustainable development. The examination is written and oral. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: Upon successful completion of this course, students will: • gain knowledge and insight into the global challenges facing humanity, understanding the need to maintain sustainable development on our planet, • gain insight into the political activities of the states in addressing economic, social and environmental problems, • gain skills to analyse the changing nature of global security and the manifestations of crisis, • has knowledge and skills to participate in the search, formulation and implementation of means aimed at achieving a sustainable quality of life and behavioural change in human society.	
Brief content of the subject: 1. Basic concepts and pillars of sustainable development. 2. History of inequality and characteristics of global human problems. 3. Dimensions of population growth. The problem of poverty. 4. The food problem. 5. The health status of the population. 6. The changing nature of global security in the 21st century. 7. Environmental assessment and labelling of products in the EU. 8. Principles for applying sustainable development in the main economic sectors. 9. Principles for applying sustainable development in the non-productive sphere: education, upbringing, economic system, tourism, human settlements, people's value orientation and nutrition. 10. Ways of promoting the principles and criteria of sustainable development. 11. Explanation of the concept of globalisation, social and environmental problems of the current stage of globalisation. 12. Sustainable development in terms of environmental impact assessment and environmental burdens. 13. Millennium Development Goals, Sustainable Development Agenda. EU and Slovak strategies in the context of sustainable development.	
Recommended literature:	

Pinderhughes, R. 2004. Alternative urban futures: Planning for sustainable development in cities throughout the world. Rowman and Littlefield Pub, 2004. ISBN 978-07-4252-367-8.					
Language, knowledge of which is necessary to complete the subject: Slovak, English					
Subject evaluation					
A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00
Notes:					
Teacher: Assoc. Prof Mgr. Ildikó Matušíková, PhD.					
Date of last change: 28.02.2022					
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KER/bd359	**Subject name: Waste Management**
Type, scope, and method of educational activities: Compulsory optional subject. **Subject type (C, CO, O):** CO **Recommended scope of teaching (in hours): 2 hours of lectures per week** **Study method:** on-site **Study form:** full-time study	
Number of credits: 2	
Recommended semester/trimester of study: semester 5	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	

Conditions for completing the subject:

The acquired knowledge and competences of the students will be tested during the semester by 2 intermediate tests, while only students who achieve a minimum of 50 % of the points from these intermediate tests will be admitted to the final exam.

Overall evaluation of the course:

A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>;
B - very good (above the average standard but with some errors) = 1.5 <83-91 %>;
C - good (generally sound work with a number of notable errors) = 2 <74-82 %>;
D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>;
E - sufficient (performance meets the minimum criteria) =3 <56-64 %>;
FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>

Educational outcomes:

Upon successful completion of this course, the student will gain:

- knowledge and competence in waste management issues, especially in the field of collection waste management and disposal;
- knowledge of new technologies in the field of waste recycling;
- competence in national environmental policy strategies and priorities in relation to waste management.

Brief content of the subject:

1. Introduction to the course of Waste Management and definitions, history.
2. Waste collection management, waste management logistics.
3. Waste collection system.
4. Separate waste collection.
5. Waste collection and management.
6. Waste transport, transfer stations.
7. Classification of wastes, assessment of waste properties.
8. Packaging waste, wastewaters, airborne waste.
9. Physical, chemical and biological methods of waste treatment, composting.
10. Modern methods and approaches to waste treatment.
11. State of waste management in the Slovak Republic, International aspects of waste management.
12. Legislation on Waste Management (Waste Act No. 79/2015, decrees of the Ministry of Environment of the Slovak Republic on waste issues).

Recommended literature:

MOSER, H. – RÖMBKE, J. 2009. Ecotoxicological characterization of waste. New York : Springer-Verlag, 2009. 314 s. ISBN 978-0-387-88959-7.

LUDWIG, CH. – HELLWEG, S. – STUCKI, S. 2003. Municipal solid waste management. New York : Springer-Verlag, 2003. 535 s. ISBN 978-3-642-55636-4.

Language, knowledge of which is necessary to complete the subject: Slovak, English

Subject evaluation

A	B	C	D	E	FX

0.00	0.00	0.00	0.00	0.00	0.00
Notes:					
Teacher: Assoc. Prof. RNDr. Miroslav Horník, PhD.					
Date of last change: 28.02.2022					
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.					

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Optional subjects

University of Ss. Cyril and Methodius in Trnava
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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KB/bd316	**Subject name: Sports Activity I**
Type, scope, and method of educational activities: Optional subject. **Subject type (C, CO, O):** O **Recommended scope of teaching (in hours):** 2 hours of seminars per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 2	
Recommended semester/trimester of study: semester 1	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: During the semester, students' active participation in the course will be evaluated, for which the student will be evaluated with a maximum of 100 points. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: The aim of the course is to lead students to active leisure and physical activity as part of the quality of life.	
Brief content of the subject: Sport activities offered by UCM and FNS.	
Recommended literature:	
Language, knowledge of which is necessary to complete the subject: Slovak, English	

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:
Teacher: Ing. Eva Ürgeová, PhD.
Date of last change: 28.02.2022
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

University of Ss. Cyril and Methodius in Trnava
Námestie Jozefa Herdu 2
917 01 Trnava

SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KB/bd317	**Subject name: Sports Activity II**
Type, scope, and method of educational activities: Optional subject. **Subject type (C, CO, O):** O **Recommended scope of teaching (in hours):** 2 hours of seminars per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 2	
Recommended semester/trimester of study: semester 2	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: During the semester, students' active participation in the course will be evaluated, for which the student will be evaluated with a maximum of 100 points. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: The aim of the course is to lead students to active leisure and physical activity as part of the quality of life.	
Brief content of the subject: Sport activities offered by UCM and FNS.	
Recommended literature:	
Language, knowledge of which is necessary to complete the subject: Slovak, English	
Subject evaluation	

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:
Teacher: Ing. Eva Ürgeová, PhD.
Date of last change: 28.02.2022
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KB/bd343	**Subject name: Sports Activity III**
Type, scope, and method of educational activities: Optional subject. **Subject type (C, CO, O):** O **Recommended scope of teaching (in hours):** 2 hours of seminars per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 2	
Recommended semester/trimester of study: semester 3	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: During the semester, students' active participation in the course will be evaluated, for which the student will be evaluated with a maximum of 100 points. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: The aim of the course is to lead students to active leisure and physical activity as part of the quality of life.	
Brief content of the subject: Sport activities offered by UCM and FNS.	
Recommended literature:	
Language, knowledge of which is necessary to complete the subject: Slovak, English	
Subject evaluation	

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:
Teacher: Ing. Eva Ürgeová, PhD.
Date of last change: 28.02.2022
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KB/bd344	**Subject name: Sports Activity IV**
Type, scope, and method of educational activities: Optional subject. **Subject type (C, CO, O):** O **Recommended scope of teaching (in hours):** 2 hours of seminars per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 2	
Recommended semester/trimester of study: semester 4	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: During the semester, students' active participation in the course will be evaluated, for which the student will be evaluated with a maximum of 100 points. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: The aim of the course is to lead students to active leisure and physical activity as part of the quality of life.	
Brief content of the subject: Sport activities offered by UCM and FNS.	
Recommended literature:	
Language, knowledge of which is necessary to complete the subject: Slovak, English	
Subject evaluation	

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:
Teacher: Ing. Eva Ürgeová, PhD.
Date of last change: 28.02.2022
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SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KB/bd364	**Subject name: Sports Activity V**
Type, scope, and method of educational activities: Optional subject. **Subject type (C, CO, O):** O **Recommended scope of teaching (in hours):** 2 hours of seminars per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 2	
Recommended semester/trimester of study: semester 5	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: During the semester, students' active participation in the course will be evaluated, for which the student will be evaluated with a maximum of 100 points. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: The aim of the course is to lead students to active leisure and physical activity as part of the quality of life.	
Brief content of the subject: Sport activities offered by UCM and FNS.	
Recommended literature:	
Language, knowledge of which is necessary to complete the subject: Slovak, English	
Subject evaluation	

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:
Teacher: Ing. Eva Ürgeová, PhD.
Date of last change: 28.02.2022
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.

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917 01 Trnava

SUBJECT INFORMATION SHEET

University: University of Ss. Cyril and Methodius in Trnava	
Faculty/institute: Faculty of Natural Sciences	
Subject code: KB/bd344	**Subject name: Sports Activity VI**
Type, scope, and method of educational activities: Optional subject. **Subject type (C, CO, O):** O **Recommended scope of teaching (in hours):** 2 hours of seminars per week **Study method:** on-site **Study form:** full-time study	
Number of credits: 2	
Recommended semester/trimester of study: semester 6	
Level of study: bachelor	
Prerequisite subjects: without prerequisite subjects	
Conditions for completing the subject: During the semester, students' active participation in the course will be evaluated, for which the student will be evaluated with a maximum of 100 points. **Overall evaluation of the course:** A - excellent (outstanding performance with only minor errors) = 1 <92-100 %>; B - very good (above the average standard but with some errors) = 1.5 <83-91 %>; C - good (generally sound work with a number of notable errors) = 2 <74-82 %>; D - satisfactory (fair bad with significant shortcomings) = 2.5 <65-73 %>; E - sufficient (performance meets the minimum criteria) =3 <56-64 %>; FX - fail (some more work required before the credit can be awarded) = 4 <0-55 %>	
Educational outcomes: The aim of the course is to lead students to active leisure and physical activity as part of the quality of life.	
Brief content of the subject: Sport activities offered by UCM and FNS.	
Recommended literature:	
Language, knowledge of which is necessary to complete the subject: Slovak, English	

Subject evaluation

A	B	C	D	E	FX
0.00	0.00	0.00	0.00	0.00	0.00

Notes:
Teacher: Ing. Eva Ürgeová, PhD.
Date of last change: 28.02.2022
Approved: Assoc. Prof. RNDr. Miroslav Ondrejovič, PhD.