

## Course descriptions

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## COURSE DESCRIPTION

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|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| <b>Academic year:</b> 2022/2023                                                                                                                                                                                                     |                                                      |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                                                   |                                                      |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                                                     |                                                      |
| <b>Course ID:</b><br>FMFI.KJFB/3-FJF-034/15                                                                                                                                                                                         | <b>Course title:</b><br>Accelerator Ion Technologies |
| <b>Educational activities:</b><br><b>Type of activities:</b> lecture / laboratory practicals<br><b>Number of hours:</b><br><b>per week:</b> 2 / 3 <b>per level/semester:</b> 26 / 39<br><b>Form of the course:</b> on-site learning |                                                      |
| <b>Number of credits:</b> 10                                                                                                                                                                                                        |                                                      |
| <b>Recommended semester:</b> 1.                                                                                                                                                                                                     |                                                      |
| <b>Educational level:</b> III.                                                                                                                                                                                                      |                                                      |
| <b>Prerequisites:</b>                                                                                                                                                                                                               |                                                      |
| <b>Course requirements:</b>                                                                                                                                                                                                         |                                                      |
| <b>Learning outcomes:</b>                                                                                                                                                                                                           |                                                      |
| <b>Class syllabus:</b>                                                                                                                                                                                                              |                                                      |
| <b>Recommended literature:</b>                                                                                                                                                                                                      |                                                      |
| <b>Languages necessary to complete the course:</b>                                                                                                                                                                                  |                                                      |
| <b>Notes:</b>                                                                                                                                                                                                                       |                                                      |
| <b>Past grade distribution</b><br>Total number of evaluated students: 11                                                                                                                                                            |                                                      |
| ABS                                                                                                                                                                                                                                 | NEABS                                                |
| 100,0                                                                                                                                                                                                                               | 0,0                                                  |
| <b>Lecturers:</b> doc. RNDr. Miroslav Jeřkovský, PhD., Ing. Jakub Kaizer, PhD.                                                                                                                                                      |                                                      |
| <b>Last change:</b> 17.06.2022                                                                                                                                                                                                      |                                                      |
| <b>Approved by:</b>                                                                                                                                                                                                                 |                                                      |

## COURSE DESCRIPTION

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| <b>Academic year:</b> 2022/2023                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                      |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                      |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                      |
| <b>Course ID:</b><br>FMFI.KJFB/3-FJF-035/15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Course title:</b><br>Advanced High Energy Physics |
| <b>Educational activities:</b><br><b>Type of activities:</b> lecture / independent work<br><b>Number of hours:</b><br><b>per week:</b> 2 / 1 <b>per level/semester:</b> 26 / 13<br><b>Form of the course:</b> on-site learning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                      |
| <b>Number of credits:</b> 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                      |
| <b>Recommended semester:</b> 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                      |
| <b>Educational level:</b> III.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                      |
| <b>Prerequisites:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                      |
| <b>Course requirements:</b><br>Interim evaluation: homeworks (30%)<br>Final assessment: oral exam (70%), to attend the final exam, student have to work up the homeworks during semester<br>Scale of evaluation: A 90%, B 80%, C 70%, D 60%, E 50%<br>Scale of assessment (preliminary/final): 30/70                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                      |
| <b>Learning outcomes:</b><br>Students will deepen their knowledge of electromagnetic, weak and strong interactions of particles, of deep-inelastic processes - especially about electron-proton and hadron-hadron inelastic scattering. A new view on higher-order processes and the renormalization procedure will be given. The basics of quantum chromodynamics will be explained, including the evolution equations for quark and gluon densities. Furthermore, there will be questions about weak processes and associated C, P and CP-parity violation phenomena, questions of unification of electromagnetic and weak interactions, and the basics of the Standard Model and the new physics.                                                                                                                                                                                                                                                                                                                                                                 |                                                      |
| <b>Class syllabus:</b><br>:<br>1. Brief overview of the basics of elementary particle physics<br>2. Interaction of spin 0 and 1/2 particles with electromagnetic field.<br>3. On field quantization. The scattering matrix and its expansion.<br>4. Causality and Green's function, propagators of particles with different spin<br>5. Second order perturbation theory and charge renormalization, running coupling constant.<br>6. Dimensional regularization and renormalization.<br>7. Structure of hadrons. Parton model, parton distribution functions.<br>8. Fundamentals of quantum chromodynamics. Evolution of quark and gluon densities - DGLAP.<br>9. QCD application. Top quark physics – production cross sections: theory and experiment,<br>10. Weak interactions, muon decay; C, P and CP violation. Oscillations of neutral K-, D-, B-mesons.<br>11. Electro-weak unification, calibration symmetries, spontaneous symmetry breaking.<br>12. Standard model. Particle masses.<br>13. Physics of Higgs boson, vector W and Z bosons and new physics |                                                      |

**Recommended literature:**

Introduction to elementary particles / David Griffiths. Weinheim : Wiley-VCH, 2008  
Quarks and leptons: : An introductory course in modern particle physics / Francis Halzen, Alan D. Martin. [s.l.] : John Wiley, 1984  
An introduction to quantum field theory / Michael E. Peskin, Daniel V. Schroeder. Boulder : Westview Press, 1995  
Expected performance of the ATLAS experiment detector, trigger and physics : The ATLAS collaboration : Volume 3: Higgs Boson, supersymmetry, exotic processes. Geneva : CERN-OPEN, 2009

**Languages necessary to complete the course:**

Slovak, English

**Notes:****Past grade distribution**

Total number of evaluated students: 9

| ABS   | NEABS |
|-------|-------|
| 100,0 | 0,0   |

**Lecturers:** prof. RNDr. Stanislav Tokár, DrSc., doc. Mgr. Pavol Bartoš, PhD.

**Last change:** 22.06.2022

**Approved by:**

## COURSE DESCRIPTION

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| <b>Academic year:</b> 2022/2023                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                  |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                  |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                  |
| <b>Course ID:</b><br>FMFL.KJFB/3-FJF-037/15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>Course title:</b><br>Advanced Nuclear Physics |
| <b>Educational activities:</b><br><b>Type of activities:</b> lecture<br><b>Number of hours:</b><br><b>per week: 2 per level/semester: 26</b><br><b>Form of the course:</b> on-site learning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                  |
| <b>Number of credits:</b> 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                  |
| <b>Recommended semester:</b> 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                  |
| <b>Educational level:</b> III.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                  |
| <b>Prerequisites:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                  |
| <b>Course requirements:</b><br>Evaluation during the semester: homeworks<br>Final evaluation: oral exam<br>50% points needed to pass exam                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                  |
| <b>Learning outcomes:</b><br>The student gains more detailed knowledge of the nuclear physics topics, the structure of atomic nuclei and typical projects running nowadays.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                  |
| <b>Class syllabus:</b><br>Summary of nuclear models. Spherical shell model and nuclear excitations, Deformation of the nucleus, magnetic and electric moments of nuclei. Deformed shell model. Shape coexistence. Collective excitations.<br>Nuclear isomers. Decay spectroscopy. Laser spectroscopy. Nuclear fission.<br>Selected topics for various topics. Neutron and proton halo. Influence of nuclear structure on astrophysical reactions. Proton and neutron dripline. Influence of closed-shell on the stability and decay of atomic nuclei. New magic numbers. Production and properties of superheavy elements. Chemistry of superheavy elements.<br>The complete fusion reaction and separation of reaction products. Transfer reactions. Nuclear fragmentation and separation of fragments. Radioactive-ion beam measurements. Post-acceleration of radioactive beams. |                                                  |
| <b>Recommended literature:</b><br>Nuclear structure from a simple perspective / R. F. Casten. Oxford : Oxford University Press, 2000<br>Introductory nuclear physics / Kenneth S. Krane. Hoboken : Wiley, 1988<br>Basic ideas and concepts in nuclear physics an introductory approach / Kris Heyde. Bristol : Institute of Physics Publishing, 1999<br>Cyriel Wagemans, The Nuclear Fission Process, CRC Press, 1991<br>K.S. Krane, Introductory Nuclear Physics, John Wiley & Sons, 1988.                                                                                                                                                                                                                                                                                                                                                                                         |                                                  |
| <b>Languages necessary to complete the course:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                  |

|                                                     |       |
|-----------------------------------------------------|-------|
| <b>Notes:</b>                                       |       |
| <b>Past grade distribution</b>                      |       |
| Total number of evaluated students: 9               |       |
| ABS                                                 | NEABS |
| 100,0                                               | 0,0   |
| <b>Lecturers:</b> doc. Mgr. Stanislav Antalic, PhD. |       |
| <b>Last change:</b> 21.06.2022                      |       |
| <b>Approved by:</b>                                 |       |

## COURSE DESCRIPTION

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| <b>Academic year:</b> 2022/2023                                                                                                                                                                    |                                               |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                  |                                               |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                    |                                               |
| <b>Course ID:</b><br>FMFI.KJFB/3-FJF-040/22                                                                                                                                                        | <b>Course title:</b><br>Astroparticle Physics |
| <b>Educational activities:</b><br><b>Type of activities:</b> lecture<br><b>Number of hours:</b><br><b>per week:</b> 2 <b>per level/semester:</b> 26<br><b>Form of the course:</b> on-site learning |                                               |
| <b>Number of credits:</b> 10                                                                                                                                                                       |                                               |
| <b>Recommended semester:</b> 2.                                                                                                                                                                    |                                               |
| <b>Educational level:</b> III.                                                                                                                                                                     |                                               |
| <b>Prerequisites:</b>                                                                                                                                                                              |                                               |
| <b>Course requirements:</b>                                                                                                                                                                        |                                               |
| <b>Learning outcomes:</b>                                                                                                                                                                          |                                               |
| <b>Class syllabus:</b>                                                                                                                                                                             |                                               |
| <b>Recommended literature:</b>                                                                                                                                                                     |                                               |
| <b>Languages necessary to complete the course:</b>                                                                                                                                                 |                                               |
| <b>Notes:</b>                                                                                                                                                                                      |                                               |
| <b>Past grade distribution</b><br>Total number of evaluated students: 0                                                                                                                            |                                               |
| ABS                                                                                                                                                                                                | NEABS                                         |
| 0,0                                                                                                                                                                                                | 0,0                                           |
| <b>Lecturers:</b>                                                                                                                                                                                  |                                               |
| <b>Last change:</b>                                                                                                                                                                                |                                               |
| <b>Approved by:</b>                                                                                                                                                                                |                                               |

## COURSE DESCRIPTION

|                                                                                                                                                                                                               |                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
| <b>Academic year:</b> 2022/2023                                                                                                                                                                               |                                                |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                             |                                                |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                               |                                                |
| <b>Course ID:</b><br>FMFI.KJFB/3-FJF-301/15                                                                                                                                                                   | <b>Course title:</b><br>Category A Publication |
| <b>Educational activities:</b><br><b>Type of activities:</b> independent work<br><b>Number of hours:</b><br><b>per week:</b> 30 <b>per level/semester:</b> 390<br><b>Form of the course:</b> on-site learning |                                                |
| <b>Number of credits:</b> 30                                                                                                                                                                                  |                                                |
| <b>Recommended semester:</b> 3.                                                                                                                                                                               |                                                |
| <b>Educational level:</b> III.                                                                                                                                                                                |                                                |
| <b>Prerequisites:</b>                                                                                                                                                                                         |                                                |
| <b>Course requirements:</b>                                                                                                                                                                                   |                                                |
| <b>Learning outcomes:</b>                                                                                                                                                                                     |                                                |
| <b>Class syllabus:</b>                                                                                                                                                                                        |                                                |
| <b>Recommended literature:</b>                                                                                                                                                                                |                                                |
| <b>Languages necessary to complete the course:</b>                                                                                                                                                            |                                                |
| <b>Notes:</b>                                                                                                                                                                                                 |                                                |
| <b>Past grade distribution</b><br>Total number of evaluated students: 10                                                                                                                                      |                                                |
| ABS                                                                                                                                                                                                           | NEABS                                          |
| 100,0                                                                                                                                                                                                         | 0,0                                            |
| <b>Lecturers:</b>                                                                                                                                                                                             |                                                |
| <b>Last change:</b> 02.06.2015                                                                                                                                                                                |                                                |
| <b>Approved by:</b>                                                                                                                                                                                           |                                                |

## COURSE DESCRIPTION

|                                                                                                                                                                                                    |                                                                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| <b>Academic year:</b> 2022/2023                                                                                                                                                                    |                                                                   |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                  |                                                                   |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                    |                                                                   |
| <b>Course ID:</b><br>FMFI.KJFB/3-FJF-026/15                                                                                                                                                        | <b>Course title:</b><br>Computer Simulations in Radiation Physics |
| <b>Educational activities:</b><br><b>Type of activities:</b> lecture<br><b>Number of hours:</b><br><b>per week:</b> 2 <b>per level/semester:</b> 26<br><b>Form of the course:</b> on-site learning |                                                                   |
| <b>Number of credits:</b> 10                                                                                                                                                                       |                                                                   |
| <b>Recommended semester:</b> 1.                                                                                                                                                                    |                                                                   |
| <b>Educational level:</b> III.                                                                                                                                                                     |                                                                   |
| <b>Prerequisites:</b>                                                                                                                                                                              |                                                                   |
| <b>Course requirements:</b>                                                                                                                                                                        |                                                                   |
| <b>Learning outcomes:</b>                                                                                                                                                                          |                                                                   |
| <b>Class syllabus:</b>                                                                                                                                                                             |                                                                   |
| <b>Recommended literature:</b>                                                                                                                                                                     |                                                                   |
| <b>Languages necessary to complete the course:</b>                                                                                                                                                 |                                                                   |
| <b>Notes:</b>                                                                                                                                                                                      |                                                                   |
| <b>Past grade distribution</b><br>Total number of evaluated students: 11                                                                                                                           |                                                                   |
| ABS                                                                                                                                                                                                | NEABS                                                             |
| 100,0                                                                                                                                                                                              | 0,0                                                               |
| <b>Lecturers:</b> prof. RNDr. Jozef Masarik, DrSc., doc. Mgr. Róbert Breier, PhD.                                                                                                                  |                                                                   |
| <b>Last change:</b> 02.06.2015                                                                                                                                                                     |                                                                   |
| <b>Approved by:</b>                                                                                                                                                                                |                                                                   |

## COURSE DESCRIPTION

|                                                                                                                                                                                                                          |      |     |     |                                                               |     |     |       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----|-----|---------------------------------------------------------------|-----|-----|-------|
| <b>Academic year:</b> 2022/2023                                                                                                                                                                                          |      |     |     |                                                               |     |     |       |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                                        |      |     |     |                                                               |     |     |       |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                                          |      |     |     |                                                               |     |     |       |
| <b>Course ID:</b><br>FMFI.KJP/3-MXX-101/15                                                                                                                                                                               |      |     |     | <b>Course title:</b><br>Course of English for PhD Studies (1) |     |     |       |
| <b>Educational activities:</b><br><b>Type of activities:</b> practicals<br><b>Number of hours:</b><br><b>per week:</b> 2 <b>per level/semester:</b> 26<br><b>Form of the course:</b> on-site learning, distance learning |      |     |     |                                                               |     |     |       |
| <b>Number of credits:</b> 5                                                                                                                                                                                              |      |     |     |                                                               |     |     |       |
| <b>Recommended semester:</b> 1.                                                                                                                                                                                          |      |     |     |                                                               |     |     |       |
| <b>Educational level:</b> III.                                                                                                                                                                                           |      |     |     |                                                               |     |     |       |
| <b>Prerequisites:</b>                                                                                                                                                                                                    |      |     |     |                                                               |     |     |       |
| <b>Course requirements:</b>                                                                                                                                                                                              |      |     |     |                                                               |     |     |       |
| <b>Learning outcomes:</b>                                                                                                                                                                                                |      |     |     |                                                               |     |     |       |
| <b>Class syllabus:</b>                                                                                                                                                                                                   |      |     |     |                                                               |     |     |       |
| <b>Recommended literature:</b>                                                                                                                                                                                           |      |     |     |                                                               |     |     |       |
| <b>Languages necessary to complete the course:</b>                                                                                                                                                                       |      |     |     |                                                               |     |     |       |
| <b>Notes:</b>                                                                                                                                                                                                            |      |     |     |                                                               |     |     |       |
| <b>Past grade distribution</b><br>Total number of evaluated students: 200                                                                                                                                                |      |     |     |                                                               |     |     |       |
| A                                                                                                                                                                                                                        | ABS  | B   | C   | D                                                             | E   | FX  | NEABS |
| 42,0                                                                                                                                                                                                                     | 53,5 | 0,5 | 0,0 | 0,0                                                           | 2,0 | 0,0 | 2,0   |
| <b>Lecturers:</b> PhDr. Alena Zemanová, Mgr. Simona Tomášková, PhD.                                                                                                                                                      |      |     |     |                                                               |     |     |       |
| <b>Last change:</b> 20.06.2022                                                                                                                                                                                           |      |     |     |                                                               |     |     |       |
| <b>Approved by:</b>                                                                                                                                                                                                      |      |     |     |                                                               |     |     |       |

## COURSE DESCRIPTION

|                                                                                                                                                                                                             |                                                             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| <b>Academic year:</b> 2022/2023                                                                                                                                                                             |                                                             |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                           |                                                             |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                             |                                                             |
| <b>Course ID:</b><br>FMFL.KJFB/3-FJF-803/15                                                                                                                                                                 | <b>Course title:</b><br>Creation of Teaching Texts and Aids |
| <b>Educational activities:</b><br><b>Type of activities:</b> independent work<br><b>Number of hours:</b><br><b>per week:</b> 5 <b>per level/semester:</b> 65<br><b>Form of the course:</b> on-site learning |                                                             |
| <b>Number of credits:</b> 5                                                                                                                                                                                 |                                                             |
| <b>Recommended semester:</b> 4.                                                                                                                                                                             |                                                             |
| <b>Educational level:</b> III.                                                                                                                                                                              |                                                             |
| <b>Prerequisites:</b>                                                                                                                                                                                       |                                                             |
| <b>Course requirements:</b>                                                                                                                                                                                 |                                                             |
| <b>Learning outcomes:</b>                                                                                                                                                                                   |                                                             |
| <b>Class syllabus:</b>                                                                                                                                                                                      |                                                             |
| <b>Recommended literature:</b>                                                                                                                                                                              |                                                             |
| <b>Languages necessary to complete the course:</b>                                                                                                                                                          |                                                             |
| <b>Notes:</b>                                                                                                                                                                                               |                                                             |
| <b>Past grade distribution</b><br>Total number of evaluated students: 2                                                                                                                                     |                                                             |
| ABS                                                                                                                                                                                                         | NEABS                                                       |
| 100,0                                                                                                                                                                                                       | 0,0                                                         |
| <b>Lecturers:</b>                                                                                                                                                                                           |                                                             |
| <b>Last change:</b> 02.06.2015                                                                                                                                                                              |                                                             |
| <b>Approved by:</b>                                                                                                                                                                                         |                                                             |

## COURSE DESCRIPTION

|                                                                                                                                                                                                    |                                                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
| <b>Academic year:</b> 2022/2023                                                                                                                                                                    |                                                |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                  |                                                |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                    |                                                |
| <b>Course ID:</b><br>FMFI.KJFB/3-FJF-203/15                                                                                                                                                        | <b>Course title:</b><br>Department Seminar (1) |
| <b>Educational activities:</b><br><b>Type of activities:</b> lecture<br><b>Number of hours:</b><br><b>per week:</b> 2 <b>per level/semester:</b> 26<br><b>Form of the course:</b> on-site learning |                                                |
| <b>Number of credits:</b> 5                                                                                                                                                                        |                                                |
| <b>Recommended semester:</b> 1.                                                                                                                                                                    |                                                |
| <b>Educational level:</b> III.                                                                                                                                                                     |                                                |
| <b>Prerequisites:</b>                                                                                                                                                                              |                                                |
| <b>Course requirements:</b>                                                                                                                                                                        |                                                |
| <b>Learning outcomes:</b>                                                                                                                                                                          |                                                |
| <b>Class syllabus:</b>                                                                                                                                                                             |                                                |
| <b>Recommended literature:</b>                                                                                                                                                                     |                                                |
| <b>Languages necessary to complete the course:</b>                                                                                                                                                 |                                                |
| <b>Notes:</b>                                                                                                                                                                                      |                                                |
| <b>Past grade distribution</b><br>Total number of evaluated students: 16                                                                                                                           |                                                |
| ABS                                                                                                                                                                                                | NEABS                                          |
| 100,0                                                                                                                                                                                              | 0,0                                            |
| <b>Lecturers:</b> prof. RNDr. Jozef Masarik, DrSc.                                                                                                                                                 |                                                |
| <b>Last change:</b> 02.06.2015                                                                                                                                                                     |                                                |
| <b>Approved by:</b>                                                                                                                                                                                |                                                |

## COURSE DESCRIPTION

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
| <b>Academic year:</b> 2022/2023                                                                                                                                                                    |                                                |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                  |                                                |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                    |                                                |
| <b>Course ID:</b><br>FMFI.KJFB/3-FJF-204/15                                                                                                                                                        | <b>Course title:</b><br>Department Seminar (2) |
| <b>Educational activities:</b><br><b>Type of activities:</b> seminar<br><b>Number of hours:</b><br><b>per week:</b> 2 <b>per level/semester:</b> 26<br><b>Form of the course:</b> on-site learning |                                                |
| <b>Number of credits:</b> 5                                                                                                                                                                        |                                                |
| <b>Recommended semester:</b> 2.                                                                                                                                                                    |                                                |
| <b>Educational level:</b> III.                                                                                                                                                                     |                                                |
| <b>Prerequisites:</b>                                                                                                                                                                              |                                                |
| <b>Course requirements:</b>                                                                                                                                                                        |                                                |
| <b>Learning outcomes:</b>                                                                                                                                                                          |                                                |
| <b>Class syllabus:</b>                                                                                                                                                                             |                                                |
| <b>Recommended literature:</b>                                                                                                                                                                     |                                                |
| <b>Languages necessary to complete the course:</b>                                                                                                                                                 |                                                |
| <b>Notes:</b>                                                                                                                                                                                      |                                                |
| <b>Past grade distribution</b><br>Total number of evaluated students: 15                                                                                                                           |                                                |
| ABS                                                                                                                                                                                                | NEABS                                          |
| 100,0                                                                                                                                                                                              | 0,0                                            |
| <b>Lecturers:</b> prof. RNDr. Jozef Masarik, DrSc.                                                                                                                                                 |                                                |
| <b>Last change:</b> 02.06.2015                                                                                                                                                                     |                                                |
| <b>Approved by:</b>                                                                                                                                                                                |                                                |

## COURSE DESCRIPTION

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
| <b>Academic year:</b> 2022/2023                                                                                                                                                                    |                                                |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                  |                                                |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                    |                                                |
| <b>Course ID:</b><br>FMFI.KJFB/3-FJF-205/15                                                                                                                                                        | <b>Course title:</b><br>Department Seminar (3) |
| <b>Educational activities:</b><br><b>Type of activities:</b> lecture<br><b>Number of hours:</b><br><b>per week:</b> 2 <b>per level/semester:</b> 26<br><b>Form of the course:</b> on-site learning |                                                |
| <b>Number of credits:</b> 5                                                                                                                                                                        |                                                |
| <b>Recommended semester:</b> 3.                                                                                                                                                                    |                                                |
| <b>Educational level:</b> III.                                                                                                                                                                     |                                                |
| <b>Prerequisites:</b>                                                                                                                                                                              |                                                |
| <b>Course requirements:</b>                                                                                                                                                                        |                                                |
| <b>Learning outcomes:</b>                                                                                                                                                                          |                                                |
| <b>Class syllabus:</b>                                                                                                                                                                             |                                                |
| <b>Recommended literature:</b>                                                                                                                                                                     |                                                |
| <b>Languages necessary to complete the course:</b>                                                                                                                                                 |                                                |
| <b>Notes:</b>                                                                                                                                                                                      |                                                |
| <b>Past grade distribution</b><br>Total number of evaluated students: 12                                                                                                                           |                                                |
| ABS                                                                                                                                                                                                | NEABS                                          |
| 100,0                                                                                                                                                                                              | 0,0                                            |
| <b>Lecturers:</b> prof. RNDr. Jozef Masarik, DrSc.                                                                                                                                                 |                                                |
| <b>Last change:</b> 02.06.2015                                                                                                                                                                     |                                                |
| <b>Approved by:</b>                                                                                                                                                                                |                                                |

## COURSE DESCRIPTION

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|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
| <b>Academic year:</b> 2022/2023                                                                                                                                                                       |                                                |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                     |                                                |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                       |                                                |
| <b>Course ID:</b><br>FMFI.KJFB/3-FJF-206/15                                                                                                                                                           | <b>Course title:</b><br>Department Seminar (4) |
| <b>Educational activities:</b><br><b>Type of activities:</b> practicals<br><b>Number of hours:</b><br><b>per week:</b> 2 <b>per level/semester:</b> 26<br><b>Form of the course:</b> on-site learning |                                                |
| <b>Number of credits:</b> 5                                                                                                                                                                           |                                                |
| <b>Recommended semester:</b> 4.                                                                                                                                                                       |                                                |
| <b>Educational level:</b> III.                                                                                                                                                                        |                                                |
| <b>Prerequisites:</b>                                                                                                                                                                                 |                                                |
| <b>Course requirements:</b>                                                                                                                                                                           |                                                |
| <b>Learning outcomes:</b>                                                                                                                                                                             |                                                |
| <b>Class syllabus:</b>                                                                                                                                                                                |                                                |
| <b>Recommended literature:</b>                                                                                                                                                                        |                                                |
| <b>Languages necessary to complete the course:</b>                                                                                                                                                    |                                                |
| <b>Notes:</b>                                                                                                                                                                                         |                                                |
| <b>Past grade distribution</b><br>Total number of evaluated students: 9                                                                                                                               |                                                |
| ABS                                                                                                                                                                                                   | NEABS                                          |
| 100,0                                                                                                                                                                                                 | 0,0                                            |
| <b>Lecturers:</b> prof. RNDr. Jozef Masarik, DrSc.                                                                                                                                                    |                                                |
| <b>Last change:</b> 02.06.2015                                                                                                                                                                        |                                                |
| <b>Approved by:</b>                                                                                                                                                                                   |                                                |

## COURSE DESCRIPTION

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| <b>Academic year:</b> 2022/2023                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                    |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                                                                                                                                                                                                                                                          |                                                                    |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                                                                                                                                                                                                                                                            |                                                                    |
| <b>Course ID:</b><br>FMFI.KJFB/3-FJF-023/15                                                                                                                                                                                                                                                                                                                                                                                                | <b>Course title:</b><br>Detection Technique and Monitoring Systems |
| <b>Educational activities:</b><br><b>Type of activities:</b> lecture<br><b>Number of hours:</b><br><b>per week: 2 per level/semester: 26</b><br><b>Form of the course:</b> on-site learning                                                                                                                                                                                                                                                |                                                                    |
| <b>Number of credits:</b> 10                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                    |
| <b>Recommended semester:</b> 1.                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                    |
| <b>Educational level:</b> III.                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                    |
| <b>Prerequisites:</b>                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                    |
| <b>Course requirements:</b><br>Exam: written and oral exam, successful completion of the written part is condition of the oral part.<br>Share in the overall rating: 80/20.<br>Indicative assessment scale: A 90%, B 80%, C 70%, D 60%, E 50%<br>Scale of assessment (preliminary/final): 0/100                                                                                                                                            |                                                                    |
| <b>Learning outcomes:</b><br>Students should be able to apply complex methods for determination of basic physical characteristics and use detection systems in various areas of human activity.                                                                                                                                                                                                                                            |                                                                    |
| <b>Class syllabus:</b><br>Fundamental physics and characteristic properties of detectors, ionization measurement methods, position measurement - particle trajectories, interaction sites, time measurement, particle identification, energy measurement, momentum measurement, applications of detection systems - medical applications, geophysical applications, space research, detection systems for high energy physics experiments. |                                                                    |
| <b>Recommended literature:</b><br>Gamma- and X-Ray spectrometry with semiconductor detectors / Klaus Debertin, Richard G. Helmer. Amsterdam : Elsevier, 1988                                                                                                                                                                                                                                                                               |                                                                    |
| <b>Languages necessary to complete the course:</b><br>Slovak, English                                                                                                                                                                                                                                                                                                                                                                      |                                                                    |
| <b>Notes:</b>                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                    |
| <b>Past grade distribution</b><br>Total number of evaluated students: 7                                                                                                                                                                                                                                                                                                                                                                    |                                                                    |
| ABS                                                                                                                                                                                                                                                                                                                                                                                                                                        | NEABS                                                              |
| 100,0                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0,0                                                                |
| <b>Lecturers:</b> doc. RNDr. Ivan Sýkora, PhD., Mgr. Ivan Kontuľ, PhD.                                                                                                                                                                                                                                                                                                                                                                     |                                                                    |

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| <b>Last change:</b> 20.06.2022 |
| <b>Approved by:</b>            |

## STATE EXAM DESCRIPTION

|                                                                 |                                                     |
|-----------------------------------------------------------------|-----------------------------------------------------|
| <b>Academic year:</b> 2022/2023                                 |                                                     |
| <b>University:</b> Comenius University Bratislava               |                                                     |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics |                                                     |
| <b>Course ID:</b><br>FMFI.KJFB/3-FJF-990/15                     | <b>Course title:</b><br>Dissertation Thesis Defense |
| <b>Number of credits:</b> 30                                    |                                                     |
| <b>Educational level:</b> III.                                  |                                                     |
| <b>State exam syllabus:</b>                                     |                                                     |
| <b>Last change:</b> 02.06.2015                                  |                                                     |
| <b>Approved by:</b>                                             |                                                     |

## COURSE DESCRIPTION

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| <b>Academic year:</b> 2022/2023                                                                                                                                                                                       |                                                                           |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                                     |                                                                           |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                                       |                                                                           |
| <b>Course ID:</b><br>FMFI.KJFB/3-FJF-033/15                                                                                                                                                                           | <b>Course title:</b><br>English Seminar on Nuclear and Subnuclear Physics |
| <b>Educational activities:</b><br><b>Type of activities:</b> lecture / seminar<br><b>Number of hours:</b><br><b>per week:</b> 1 / 2 <b>per level/semester:</b> 13 / 26<br><b>Form of the course:</b> on-site learning |                                                                           |
| <b>Number of credits:</b> 10                                                                                                                                                                                          |                                                                           |
| <b>Recommended semester:</b> 1.                                                                                                                                                                                       |                                                                           |
| <b>Educational level:</b> III.                                                                                                                                                                                        |                                                                           |
| <b>Prerequisites:</b>                                                                                                                                                                                                 |                                                                           |
| <b>Course requirements:</b>                                                                                                                                                                                           |                                                                           |
| <b>Learning outcomes:</b>                                                                                                                                                                                             |                                                                           |
| <b>Class syllabus:</b>                                                                                                                                                                                                |                                                                           |
| <b>Recommended literature:</b>                                                                                                                                                                                        |                                                                           |
| <b>Languages necessary to complete the course:</b>                                                                                                                                                                    |                                                                           |
| <b>Notes:</b>                                                                                                                                                                                                         |                                                                           |
| <b>Past grade distribution</b><br>Total number of evaluated students: 16                                                                                                                                              |                                                                           |
| ABS                                                                                                                                                                                                                   | NEABS                                                                     |
| 100,0                                                                                                                                                                                                                 | 0,0                                                                       |
| <b>Lecturers:</b> prof. RNDr. Pavel Povinec, DrSc., prof. RNDr. Jozef Masarik, DrSc.                                                                                                                                  |                                                                           |
| <b>Last change:</b> 02.06.2015                                                                                                                                                                                        |                                                                           |
| <b>Approved by:</b>                                                                                                                                                                                                   |                                                                           |

## COURSE DESCRIPTION

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| <b>Academic year:</b> 2022/2023                                                                                                                                                    |                                                                                                 |
| <b>University:</b> Comenius University Bratislava                                                                                                                                  |                                                                                                 |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                    |                                                                                                 |
| <b>Course ID:</b><br>FMFL.KJFB/3-FJF-804/15                                                                                                                                        | <b>Course title:</b><br>Guidance of a Project for the Students' Conference or of a Final Thesis |
| <b>Educational activities:</b><br><b>Type of activities:</b> other<br><b>Number of hours:</b><br>per week: 5 per level/semester: 65<br><b>Form of the course:</b> on-site learning |                                                                                                 |
| <b>Number of credits:</b> 5                                                                                                                                                        |                                                                                                 |
| <b>Recommended semester:</b> 4.                                                                                                                                                    |                                                                                                 |
| <b>Educational level:</b> III.                                                                                                                                                     |                                                                                                 |
| <b>Prerequisites:</b>                                                                                                                                                              |                                                                                                 |
| <b>Course requirements:</b>                                                                                                                                                        |                                                                                                 |
| <b>Learning outcomes:</b>                                                                                                                                                          |                                                                                                 |
| <b>Class syllabus:</b>                                                                                                                                                             |                                                                                                 |
| <b>Recommended literature:</b>                                                                                                                                                     |                                                                                                 |
| <b>Languages necessary to complete the course:</b>                                                                                                                                 |                                                                                                 |
| <b>Notes:</b>                                                                                                                                                                      |                                                                                                 |
| <b>Past grade distribution</b><br>Total number of evaluated students: 1                                                                                                            |                                                                                                 |
| ABS                                                                                                                                                                                | NEABS                                                                                           |
| 100,0                                                                                                                                                                              | 0,0                                                                                             |
| <b>Lecturers:</b>                                                                                                                                                                  |                                                                                                 |
| <b>Last change:</b> 02.06.2015                                                                                                                                                     |                                                                                                 |
| <b>Approved by:</b>                                                                                                                                                                |                                                                                                 |

## COURSE DESCRIPTION

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| <b>Academic year:</b> 2022/2023                                                                                                                                                                               |                                                                                |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                             |                                                                                |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                               |                                                                                |
| <b>Course ID:</b><br>FMFI.KJFB/3-FJF-111/15                                                                                                                                                                   | <b>Course title:</b><br>Individual Study of Science and Research Resources (1) |
| <b>Educational activities:</b><br><b>Type of activities:</b> independent work<br><b>Number of hours:</b><br><b>per week:</b> 10 <b>per level/semester:</b> 130<br><b>Form of the course:</b> on-site learning |                                                                                |
| <b>Number of credits:</b> 10                                                                                                                                                                                  |                                                                                |
| <b>Recommended semester:</b> 1.                                                                                                                                                                               |                                                                                |
| <b>Educational level:</b> III.                                                                                                                                                                                |                                                                                |
| <b>Prerequisites:</b>                                                                                                                                                                                         |                                                                                |
| <b>Course requirements:</b>                                                                                                                                                                                   |                                                                                |
| <b>Learning outcomes:</b>                                                                                                                                                                                     |                                                                                |
| <b>Class syllabus:</b>                                                                                                                                                                                        |                                                                                |
| <b>Recommended literature:</b>                                                                                                                                                                                |                                                                                |
| <b>Languages necessary to complete the course:</b>                                                                                                                                                            |                                                                                |
| <b>Notes:</b>                                                                                                                                                                                                 |                                                                                |
| <b>Past grade distribution</b><br>Total number of evaluated students: 19                                                                                                                                      |                                                                                |
| ABS                                                                                                                                                                                                           | NEABS                                                                          |
| 100,0                                                                                                                                                                                                         | 0,0                                                                            |
| <b>Lecturers:</b>                                                                                                                                                                                             |                                                                                |
| <b>Last change:</b> 02.06.2015                                                                                                                                                                                |                                                                                |
| <b>Approved by:</b>                                                                                                                                                                                           |                                                                                |

## COURSE DESCRIPTION

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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| <b>Academic year:</b> 2022/2023                                                                                                                                                                               |                                                                                |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                             |                                                                                |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                               |                                                                                |
| <b>Course ID:</b><br>FMFI.KJFB/3-FJF-112/15                                                                                                                                                                   | <b>Course title:</b><br>Individual Study of Science and Research Resources (2) |
| <b>Educational activities:</b><br><b>Type of activities:</b> independent work<br><b>Number of hours:</b><br><b>per week:</b> 10 <b>per level/semester:</b> 130<br><b>Form of the course:</b> on-site learning |                                                                                |
| <b>Number of credits:</b> 10                                                                                                                                                                                  |                                                                                |
| <b>Recommended semester:</b> 2.                                                                                                                                                                               |                                                                                |
| <b>Educational level:</b> III.                                                                                                                                                                                |                                                                                |
| <b>Prerequisites:</b>                                                                                                                                                                                         |                                                                                |
| <b>Course requirements:</b>                                                                                                                                                                                   |                                                                                |
| <b>Learning outcomes:</b>                                                                                                                                                                                     |                                                                                |
| <b>Class syllabus:</b>                                                                                                                                                                                        |                                                                                |
| <b>Recommended literature:</b>                                                                                                                                                                                |                                                                                |
| <b>Languages necessary to complete the course:</b>                                                                                                                                                            |                                                                                |
| <b>Notes:</b>                                                                                                                                                                                                 |                                                                                |
| <b>Past grade distribution</b><br>Total number of evaluated students: 15                                                                                                                                      |                                                                                |
| ABS                                                                                                                                                                                                           | NEABS                                                                          |
| 100,0                                                                                                                                                                                                         | 0,0                                                                            |
| <b>Lecturers:</b>                                                                                                                                                                                             |                                                                                |
| <b>Last change:</b> 02.06.2015                                                                                                                                                                                |                                                                                |
| <b>Approved by:</b>                                                                                                                                                                                           |                                                                                |

## COURSE DESCRIPTION

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| <b>Academic year:</b> 2022/2023                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                               |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                               |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                               |
| <b>Course ID:</b><br>FMFI.KJFB/3-FJF-039/22                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Course title:</b><br>Low-background Experiment in Underground Laboratories |
| <b>Educational activities:</b><br><b>Type of activities:</b> lecture<br><b>Number of hours:</b><br><b>per week: 2 per level/semester: 26</b><br><b>Form of the course:</b> on-site learning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                               |
| <b>Number of credits:</b> 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                               |
| <b>Recommended semester:</b> 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                               |
| <b>Educational level:</b> III.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |
| <b>Prerequisites:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                               |
| <b>Course requirements:</b><br>The evaluation of the course will be in the form of a continuous (test) and final evaluation (oral exam). Successful completion of the course reflects sufficient orientation of the student in the issue. The course will be classified as a graduate provided that the doctoral student proves the fulfilment of obligations at the level of at least 51%.<br>Scale of assessment (preliminary/final): 0/100                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                               |
| <b>Learning outcomes:</b><br>By completing the subject, students will gain knowledge about the latest trends in nuclear and particle physics experiments performed in underground laboratories using low-background detectors.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |
| <b>Class syllabus:</b> <ol style="list-style-type: none"> <li>1. Low background detectors</li> <li>2. Radiogenic background in low background nuclear physics</li> <li>3. Cosmic radiation at surface and underground</li> <li>4. Monte Carlo simulations of cosmic-ray background</li> <li>5. Monte Carlo simulations of radionuclide contributions of background</li> <li>6. Radioactive contamination of construction materials of low background detectors</li> <li>7. Radiopurity screening by radiometric methods</li> <li>8. Mass spectrometry radiopurity analyses</li> <li>9. Comparison of underground laboratories</li> <li>10. Double beta decay</li> <li>11. Dark matter</li> <li>12. Leading experiments on rare nuclear decays in underground laboratories</li> <li>13. Leading experiments on search for dark matter particles in underground laboratories</li> </ol> |                                                                               |
| <b>Recommended literature:</b><br>[1] H.V. Klapdor-Kleingrotthaus, Seventy years of double beta decay. World Scientific, (2010), S. 1520.<br>[2] B. Glegg, Dark matter and energy, Icon Books, (2019), S. 176.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |

[3] G. Heussser, Low-radioactivity background techniques. Annual Reviews of Nuclear and Particle Science, 1995, 45:543-90.

**Languages necessary to complete the course:**

Slovak, English

**Notes:**

**Past grade distribution**

Total number of evaluated students: 0

| ABS | NEABS |
|-----|-------|
| 0,0 | 0,0   |

**Lecturers:** doc. Mgr. Róbert Breier, PhD., Ing. Jakub Kaizer, PhD.

**Last change:** 17.06.2022

**Approved by:**

## COURSE DESCRIPTION

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| <b>Academic year:</b> 2022/2023                                                                                                                                                                                                                                                                                                                                                       |                                                       |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                                                                                                                                                                                                     |                                                       |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                                                                                                                                                                                                       |                                                       |
| <b>Course ID:</b><br>FMFI.KJFB/3-FJF-038/22                                                                                                                                                                                                                                                                                                                                           | <b>Course title:</b><br>Management of Scientific Work |
| <b>Educational activities:</b><br><b>Type of activities:</b> seminar<br><b>Number of hours:</b><br><b>per week: 2 per level/semester: 26</b><br><b>Form of the course:</b> on-site learning                                                                                                                                                                                           |                                                       |
| <b>Number of credits:</b> 5                                                                                                                                                                                                                                                                                                                                                           |                                                       |
| <b>Recommended semester:</b> 1.                                                                                                                                                                                                                                                                                                                                                       |                                                       |
| <b>Educational level:</b> III.                                                                                                                                                                                                                                                                                                                                                        |                                                       |
| <b>Prerequisites:</b>                                                                                                                                                                                                                                                                                                                                                                 |                                                       |
| <b>Course requirements:</b>                                                                                                                                                                                                                                                                                                                                                           |                                                       |
| <b>Learning outcomes:</b>                                                                                                                                                                                                                                                                                                                                                             |                                                       |
| <b>Class syllabus:</b><br>1. Working with professional and scientific literature and publishing databases<br>2. Principles of good scientific work<br>3. Prepare your publication<br>4. Preparation of the conference lecture<br>5. Preparation of a scientific grant<br>6. Management of scientific grants in personnel and financial terms<br>7. Conducting student and final works |                                                       |
| <b>Recommended literature:</b>                                                                                                                                                                                                                                                                                                                                                        |                                                       |
| <b>Languages necessary to complete the course:</b>                                                                                                                                                                                                                                                                                                                                    |                                                       |
| <b>Notes:</b>                                                                                                                                                                                                                                                                                                                                                                         |                                                       |
| <b>Past grade distribution</b><br>Total number of evaluated students: 3                                                                                                                                                                                                                                                                                                               |                                                       |
| ABS                                                                                                                                                                                                                                                                                                                                                                                   | NEABS                                                 |
| 100,0                                                                                                                                                                                                                                                                                                                                                                                 | 0,0                                                   |
| <b>Lecturers:</b> doc. Mgr. Stanislav Antalic, PhD., prof. RNDr. Jozef Masarik, DrSc.                                                                                                                                                                                                                                                                                                 |                                                       |
| <b>Last change:</b> 06.09.2023                                                                                                                                                                                                                                                                                                                                                        |                                                       |
| <b>Approved by:</b>                                                                                                                                                                                                                                                                                                                                                                   |                                                       |

## COURSE DESCRIPTION

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| <b>Academic year:</b> 2022/2023                                                                                                                                                                    |                                           |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                  |                                           |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                    |                                           |
| <b>Course ID:</b><br>FMFI.KJFB/3-FJF-701/15                                                                                                                                                        | <b>Course title:</b><br>Obtaining a Grant |
| <b>Educational activities:</b><br><b>Type of activities:</b> other<br><b>Number of hours:</b><br><b>per week:</b> 20 <b>per level/semester:</b> 260<br><b>Form of the course:</b> on-site learning |                                           |
| <b>Number of credits:</b> 20                                                                                                                                                                       |                                           |
| <b>Recommended semester:</b> 4.                                                                                                                                                                    |                                           |
| <b>Educational level:</b> III.                                                                                                                                                                     |                                           |
| <b>Prerequisites:</b>                                                                                                                                                                              |                                           |
| <b>Course requirements:</b>                                                                                                                                                                        |                                           |
| <b>Learning outcomes:</b>                                                                                                                                                                          |                                           |
| <b>Class syllabus:</b>                                                                                                                                                                             |                                           |
| <b>Recommended literature:</b>                                                                                                                                                                     |                                           |
| <b>Languages necessary to complete the course:</b>                                                                                                                                                 |                                           |
| <b>Notes:</b>                                                                                                                                                                                      |                                           |
| <b>Past grade distribution</b><br>Total number of evaluated students: 18                                                                                                                           |                                           |
| ABS                                                                                                                                                                                                | NEABS                                     |
| 100,0                                                                                                                                                                                              | 0,0                                       |
| <b>Lecturers:</b>                                                                                                                                                                                  |                                           |
| <b>Last change:</b> 02.06.2015                                                                                                                                                                     |                                           |
| <b>Approved by:</b>                                                                                                                                                                                |                                           |

## STATE EXAM DESCRIPTION

|                                                                 |                                                          |
|-----------------------------------------------------------------|----------------------------------------------------------|
| <b>Academic year:</b> 2022/2023                                 |                                                          |
| <b>University:</b> Comenius University Bratislava               |                                                          |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics |                                                          |
| <b>Course ID:</b><br>FMFI.KJFB/3-FJF-950/15                     | <b>Course title:</b><br>Passing Dissertation Examination |
| <b>Number of credits:</b> 20                                    |                                                          |
| <b>Educational level:</b> III.                                  |                                                          |
| <b>State exam syllabus:</b>                                     |                                                          |
| <b>Last change:</b> 02.06.2015                                  |                                                          |
| <b>Approved by:</b>                                             |                                                          |

## COURSE DESCRIPTION

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| <b>Academic year:</b> 2022/2023                                                                                                                                                                    |                                                            |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                  |                                                            |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                    |                                                            |
| <b>Course ID:</b><br>FMFI.KJFB/3-FJF-403/22                                                                                                                                                        | <b>Course title:</b><br>Presentation at Department Seminar |
| <b>Educational activities:</b><br><b>Type of activities:</b> other<br><b>Number of hours:</b><br><b>per week:</b> 20 <b>per level/semester:</b> 260<br><b>Form of the course:</b> on-site learning |                                                            |
| <b>Number of credits:</b> 20                                                                                                                                                                       |                                                            |
| <b>Recommended semester:</b> 4.                                                                                                                                                                    |                                                            |
| <b>Educational level:</b> III.                                                                                                                                                                     |                                                            |
| <b>Prerequisites:</b>                                                                                                                                                                              |                                                            |
| <b>Course requirements:</b>                                                                                                                                                                        |                                                            |
| <b>Learning outcomes:</b>                                                                                                                                                                          |                                                            |
| <b>Class syllabus:</b>                                                                                                                                                                             |                                                            |
| <b>Recommended literature:</b>                                                                                                                                                                     |                                                            |
| <b>Languages necessary to complete the course:</b>                                                                                                                                                 |                                                            |
| <b>Notes:</b>                                                                                                                                                                                      |                                                            |
| <b>Past grade distribution</b><br>Total number of evaluated students: 5                                                                                                                            |                                                            |
| ABS                                                                                                                                                                                                | NEABS                                                      |
| 100,0                                                                                                                                                                                              | 0,0                                                        |
| <b>Lecturers:</b>                                                                                                                                                                                  |                                                            |
| <b>Last change:</b>                                                                                                                                                                                |                                                            |
| <b>Approved by:</b>                                                                                                                                                                                |                                                            |

## COURSE DESCRIPTION

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| <b>Academic year:</b> 2022/2023                                                                                                                                                                             |                                                           |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                           |                                                           |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                             |                                                           |
| <b>Course ID:</b><br>FMFI.KJFB/3-FJF-402/22                                                                                                                                                                 | <b>Course title:</b><br>Presentation at a Home Conference |
| <b>Educational activities:</b><br><b>Type of activities:</b> independent work<br><b>Number of hours:</b><br><b>per week:</b> 5 <b>per level/semester:</b> 65<br><b>Form of the course:</b> on-site learning |                                                           |
| <b>Number of credits:</b> 5                                                                                                                                                                                 |                                                           |
| <b>Recommended semester:</b> 4.                                                                                                                                                                             |                                                           |
| <b>Educational level:</b> III.                                                                                                                                                                              |                                                           |
| <b>Prerequisites:</b>                                                                                                                                                                                       |                                                           |
| <b>Course requirements:</b>                                                                                                                                                                                 |                                                           |
| <b>Learning outcomes:</b>                                                                                                                                                                                   |                                                           |
| <b>Class syllabus:</b>                                                                                                                                                                                      |                                                           |
| <b>Recommended literature:</b>                                                                                                                                                                              |                                                           |
| <b>Languages necessary to complete the course:</b>                                                                                                                                                          |                                                           |
| <b>Notes:</b>                                                                                                                                                                                               |                                                           |
| <b>Past grade distribution</b><br>Total number of evaluated students: 7                                                                                                                                     |                                                           |
| ABS                                                                                                                                                                                                         | NEABS                                                     |
| 100,0                                                                                                                                                                                                       | 0,0                                                       |
| <b>Lecturers:</b>                                                                                                                                                                                           |                                                           |
| <b>Last change:</b> 22.02.2022                                                                                                                                                                              |                                                           |
| <b>Approved by:</b>                                                                                                                                                                                         |                                                           |

## COURSE DESCRIPTION

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| <b>Academic year:</b> 2022/2023                                                                                                                                                                               |                                                                     |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                             |                                                                     |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                               |                                                                     |
| <b>Course ID:</b><br>FMFI.KJFB/3-FJF-401/15                                                                                                                                                                   | <b>Course title:</b><br>Presentation at an International Conference |
| <b>Educational activities:</b><br><b>Type of activities:</b> independent work<br><b>Number of hours:</b><br><b>per week:</b> 20 <b>per level/semester:</b> 260<br><b>Form of the course:</b> on-site learning |                                                                     |
| <b>Number of credits:</b> 20                                                                                                                                                                                  |                                                                     |
| <b>Recommended semester:</b> 6.                                                                                                                                                                               |                                                                     |
| <b>Educational level:</b> III.                                                                                                                                                                                |                                                                     |
| <b>Prerequisites:</b>                                                                                                                                                                                         |                                                                     |
| <b>Course requirements:</b>                                                                                                                                                                                   |                                                                     |
| <b>Learning outcomes:</b>                                                                                                                                                                                     |                                                                     |
| <b>Class syllabus:</b>                                                                                                                                                                                        |                                                                     |
| <b>Recommended literature:</b>                                                                                                                                                                                |                                                                     |
| <b>Languages necessary to complete the course:</b>                                                                                                                                                            |                                                                     |
| <b>Notes:</b>                                                                                                                                                                                                 |                                                                     |
| <b>Past grade distribution</b><br>Total number of evaluated students: 20                                                                                                                                      |                                                                     |
| ABS                                                                                                                                                                                                           | NEABS                                                               |
| 100,0                                                                                                                                                                                                         | 0,0                                                                 |
| <b>Lecturers:</b>                                                                                                                                                                                             |                                                                     |
| <b>Last change:</b> 02.06.2015                                                                                                                                                                                |                                                                     |
| <b>Approved by:</b>                                                                                                                                                                                           |                                                                     |

## COURSE DESCRIPTION

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| <b>Academic year:</b> 2022/2023                                                                                                                                                                               |                                                              |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                             |                                                              |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                               |                                                              |
| <b>Course ID:</b><br>FMFL.KJFB/3-FJF-305/15                                                                                                                                                                   | <b>Course title:</b><br>Publication in a Reviewed Periodical |
| <b>Educational activities:</b><br><b>Type of activities:</b> independent work<br><b>Number of hours:</b><br><b>per week:</b> 15 <b>per level/semester:</b> 195<br><b>Form of the course:</b> on-site learning |                                                              |
| <b>Number of credits:</b> 15                                                                                                                                                                                  |                                                              |
| <b>Recommended semester:</b> 4.                                                                                                                                                                               |                                                              |
| <b>Educational level:</b> III.                                                                                                                                                                                |                                                              |
| <b>Prerequisites:</b>                                                                                                                                                                                         |                                                              |
| <b>Course requirements:</b>                                                                                                                                                                                   |                                                              |
| <b>Learning outcomes:</b>                                                                                                                                                                                     |                                                              |
| <b>Class syllabus:</b>                                                                                                                                                                                        |                                                              |
| <b>Recommended literature:</b>                                                                                                                                                                                |                                                              |
| <b>Languages necessary to complete the course:</b>                                                                                                                                                            |                                                              |
| <b>Notes:</b>                                                                                                                                                                                                 |                                                              |
| <b>Past grade distribution</b><br>Total number of evaluated students: 10                                                                                                                                      |                                                              |
| ABS                                                                                                                                                                                                           | NEABS                                                        |
| 100,0                                                                                                                                                                                                         | 0,0                                                          |
| <b>Lecturers:</b>                                                                                                                                                                                             |                                                              |
| <b>Last change:</b> 02.06.2015                                                                                                                                                                                |                                                              |
| <b>Approved by:</b>                                                                                                                                                                                           |                                                              |

## COURSE DESCRIPTION

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| <b>Academic year:</b> 2022/2023                                                                                                                                                      |                                                                             |
| <b>University:</b> Comenius University Bratislava                                                                                                                                    |                                                                             |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                      |                                                                             |
| <b>Course ID:</b><br>FMFI.KJFB/3-FJF-704/15                                                                                                                                          | <b>Course title:</b><br>Response to a WoK- or SCOPUS-registered Publication |
| <b>Educational activities:</b><br><b>Type of activities:</b> other<br><b>Number of hours:</b><br>per week: 3   per level/semester: 39<br><b>Form of the course:</b> on-site learning |                                                                             |
| <b>Number of credits:</b> 6                                                                                                                                                          |                                                                             |
| <b>Recommended semester:</b> 4.                                                                                                                                                      |                                                                             |
| <b>Educational level:</b> III.                                                                                                                                                       |                                                                             |
| <b>Prerequisites:</b>                                                                                                                                                                |                                                                             |
| <b>Course requirements:</b>                                                                                                                                                          |                                                                             |
| <b>Learning outcomes:</b>                                                                                                                                                            |                                                                             |
| <b>Class syllabus:</b>                                                                                                                                                               |                                                                             |
| <b>Recommended literature:</b>                                                                                                                                                       |                                                                             |
| <b>Languages necessary to complete the course:</b>                                                                                                                                   |                                                                             |
| <b>Notes:</b>                                                                                                                                                                        |                                                                             |
| <b>Past grade distribution</b><br>Total number of evaluated students: 0                                                                                                              |                                                                             |
| ABS                                                                                                                                                                                  | NEABS                                                                       |
| 0,0                                                                                                                                                                                  | 0,0                                                                         |
| <b>Lecturers:</b>                                                                                                                                                                    |                                                                             |
| <b>Last change:</b> 02.06.2015                                                                                                                                                       |                                                                             |
| <b>Approved by:</b>                                                                                                                                                                  |                                                                             |

## COURSE DESCRIPTION

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| <b>Academic year:</b> 2022/2023                                                                                                                                                                               |                                                          |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                             |                                                          |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                               |                                                          |
| <b>Course ID:</b><br>FMFL.KJFB/3-FJF-702/15                                                                                                                                                                   | <b>Course title:</b><br>Scientific Project Co-researcher |
| <b>Educational activities:</b><br><b>Type of activities:</b> independent work<br><b>Number of hours:</b><br><b>per week:</b> 10 <b>per level/semester:</b> 130<br><b>Form of the course:</b> on-site learning |                                                          |
| <b>Number of credits:</b> 10                                                                                                                                                                                  |                                                          |
| <b>Recommended semester:</b> 4.                                                                                                                                                                               |                                                          |
| <b>Educational level:</b> III.                                                                                                                                                                                |                                                          |
| <b>Prerequisites:</b>                                                                                                                                                                                         |                                                          |
| <b>Course requirements:</b>                                                                                                                                                                                   |                                                          |
| <b>Learning outcomes:</b>                                                                                                                                                                                     |                                                          |
| <b>Class syllabus:</b>                                                                                                                                                                                        |                                                          |
| <b>Recommended literature:</b>                                                                                                                                                                                |                                                          |
| <b>Languages necessary to complete the course:</b>                                                                                                                                                            |                                                          |
| <b>Notes:</b>                                                                                                                                                                                                 |                                                          |
| <b>Past grade distribution</b><br>Total number of evaluated students: 26                                                                                                                                      |                                                          |
| ABS                                                                                                                                                                                                           | NEABS                                                    |
| 100,0                                                                                                                                                                                                         | 0,0                                                      |
| <b>Lecturers:</b>                                                                                                                                                                                             |                                                          |
| <b>Last change:</b> 02.06.2015                                                                                                                                                                                |                                                          |
| <b>Approved by:</b>                                                                                                                                                                                           |                                                          |

## COURSE DESCRIPTION

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| <b>Academic year:</b> 2022/2023                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                              |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                              |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                              |
| <b>Course ID:</b><br>FMFI.KJFB/3-FJF-025/15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Course title:</b><br>Selected Topics in Radiation Physics |
| <b>Educational activities:</b><br><b>Type of activities:</b> lecture<br><b>Number of hours:</b><br><b>per week:</b> 3 <b>per level/semester:</b> 39<br><b>Form of the course:</b> on-site learning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                              |
| <b>Number of credits:</b> 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                              |
| <b>Recommended semester:</b> 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                              |
| <b>Educational level:</b> III.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                              |
| <b>Prerequisites:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                              |
| <b>Course requirements:</b><br>A student may earn 50% for the course project and presentation per semester and the final oral exam is weighted 50%. A student must earn at least half of the points for the project in order to pass the final oral exam. The student must also score at least 26 points on the final oral examination.<br>Grades: A (100-91), B (90-81), C (80-71), D (70-61), E (60-51), FX (50-0).<br>Mid-term / final assessment weighting: 50% mid-term assessment (project + presentation) / 50% final oral examination.<br>Scale of assessment (preliminary/final): 50/50                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                              |
| <b>Learning outcomes:</b><br>Students will gain up-to-date information and knowledge in radiation physics and dosimetry of ionizing radiation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                              |
| <b>Class syllabus:</b> <ol style="list-style-type: none"> <li>1. Natural and artificial sources of radiation.</li> <li>2. Migration, concentrations and variations of radionuclides.</li> <li>3. Environmental models: dispersion of radionuclides in the atmosphere, lithosphere and hydrosphere.</li> <li>4. Exposure from clouds and from deposited radionuclides.</li> <li>5. Use of radionuclides as tracers of natural processes.</li> <li>6. Use of radon in environmental studies.</li> <li>7. Dosimetry of natural and artificial radiation sources.</li> <li>8. Spectrometry of natural gamma radiation.</li> <li>9. Laboratory measurement of natural samples, monitoring of artificial radiation sources.</li> <li>10. Physical principles of microdosimetry: linear energy transfer, linear energy, specific energy.</li> <li>11. Spectra of microdosimetric quantities.</li> <li>12. Experimental methods of microdosimetry.</li> <li>13. Applications of microdosimetry in radiobiology, radiotherapy and radiation protection.</li> </ol> |                                                              |
| <b>Recommended literature:</b><br>Analysis of environmental radionuclides / editor Pavel P. Povinec. Amsterdam: Elsevier, 2008                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                              |

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| K. Froelich at al.: Environmental radionuclides: tracers and timers of terrestrial processes.<br>Elsevier, 2010<br>J.E.Till at al.: Radiological risk assessment and environmental analysis. Oxford University Press,<br>2008 |       |
| <b>Languages necessary to complete the course:</b><br>Slovak, English                                                                                                                                                         |       |
| <b>Notes:</b>                                                                                                                                                                                                                 |       |
| <b>Past grade distribution</b><br>Total number of evaluated students: 3                                                                                                                                                       |       |
| ABS                                                                                                                                                                                                                           | NEABS |
| 100,0                                                                                                                                                                                                                         | 0,0   |
| <b>Lecturers:</b> doc. RNDr. Karol Holý, CSc., doc. RNDr. Radoslav Böhm, PhD., doc. RNDr. Monika Müllerová, PhD.                                                                                                              |       |
| <b>Last change:</b> 22.06.2022                                                                                                                                                                                                |       |
| <b>Approved by:</b>                                                                                                                                                                                                           |       |

## COURSE DESCRIPTION

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| <b>Academic year:</b> 2022/2023                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                   |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                   |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                   |
| <b>Course ID:</b><br>FMFI.KJFB/3-FJF-036/15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Course title:</b><br>Subnuclear Physics Experiment Modelling and Data Analysis |
| <b>Educational activities:</b><br><b>Type of activities:</b> lecture<br><b>Number of hours:</b><br><b>per week: 2 per level/semester: 26</b><br><b>Form of the course:</b> on-site learning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                   |
| <b>Number of credits:</b> 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                   |
| <b>Recommended semester:</b> 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                   |
| <b>Educational level:</b> III.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                   |
| <b>Prerequisites:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                   |
| <b>Course requirements:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                   |
| <b>Learning outcomes:</b><br>Students will understand how to model random variables, how to simulate interaction of a particle with material and random processes in physics in general. They will further enhance their understanding of probability theory, estimators and hypothesis testing. They will expand their knowledge on applications of machine learning to solve problems in physics and gain overview of up-to-date methods of unfolding to estimate true distributions from observations smeared by experimental measurement.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                   |
| <b>Class syllabus:</b> <ol style="list-style-type: none"> <li>1. Probability theory and statistics. Error propagation and decorrelation of correlated random variables.</li> <li>2. Random number distributions encountered in physics. Generating random numbers on a computer.</li> <li>3. Estimators and statistical tests.</li> <li>4. Fisher discriminant, p-value and statistical significance of a measurement.</li> <li>5. Machine learning (ML) in physics. Application of ML for classification problem.</li> <li>6. Training of ML models, regularization methods, choice of input features, unsupervised machine learning.</li> <li>7. Deconvolution (unfolding). Issues with a naive approach to unfolding.</li> <li>8. Parametrized unfolding, Singular Value Decomposition Unfolding and Iterative Bayesian Unfolding.</li> <li>9. Hypothesis testing. Quantifying agreement between data and the model. Chi-square and likelihood approaches.</li> <li>10. Maximum likelihood fit and uncertainty estimation. Exclusion limits.</li> <li>11. Impact of systematic uncertainties on measurement precision and their inclusion via profile likelihood.</li> <li>12. Stochastic processes. Markov's chains, modelling of interaction between particles and material. Transport equation. Variance reduction methods.</li> </ol> |                                                                                   |

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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| <b>Recommended literature:</b><br>O. Behnke, K. Kröninger, G. Schott, T. Schörner-Sadenius, Data Analysis in High Energy Physics: A Practical Guide to Statistical Methods, John Wiley & Sons Inc, (2013), S. 440.<br>R. J. Barlow, Statistics: A Guide to the use of Statistical Methods in the Physical Sciences, John Wiley & Sons Inc, (1989), S. 240.<br>G. Bohm, G. Zech, Introduction to Statistics and Data Analysis for Physicists, Verlag Deutsches Elektronen-Synchrotron (2010), S. 412. 470. |       |
| <b>Languages necessary to complete the course:</b><br>Slovak, English                                                                                                                                                                                                                                                                                                                                                                                                                                     |       |
| <b>Notes:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |       |
| <b>Past grade distribution</b><br>Total number of evaluated students: 12                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |
| ABS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | NEABS |
| 100,0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0,0   |
| <b>Lecturers:</b> prof. RNDr. Stanislav Tokár, DrSc., Mgr. Michal Dubovský, PhD., Mgr. Oliver Majerský, PhD.                                                                                                                                                                                                                                                                                                                                                                                              |       |
| <b>Last change:</b> 22.06.2022                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |
| <b>Approved by:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |       |

## COURSE DESCRIPTION

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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| <b>Academic year:</b> 2022/2023                                                                                                                                                                   |                                                                  |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                 |                                                                  |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                   |                                                                  |
| <b>Course ID:</b><br>FMFI.KJFB/3-FJF-802/15                                                                                                                                                       | <b>Course title:</b><br>Teaching Practice in the Summer Semester |
| <b>Educational activities:</b><br><b>Type of activities:</b> other<br><b>Number of hours:</b><br><b>per week:</b> 8 <b>per level/semester:</b> 104<br><b>Form of the course:</b> on-site learning |                                                                  |
| <b>Number of credits:</b> 8                                                                                                                                                                       |                                                                  |
| <b>Recommended semester:</b> 2.                                                                                                                                                                   |                                                                  |
| <b>Educational level:</b> III.                                                                                                                                                                    |                                                                  |
| <b>Prerequisites:</b>                                                                                                                                                                             |                                                                  |
| <b>Course requirements:</b>                                                                                                                                                                       |                                                                  |
| <b>Learning outcomes:</b>                                                                                                                                                                         |                                                                  |
| <b>Class syllabus:</b>                                                                                                                                                                            |                                                                  |
| <b>Recommended literature:</b>                                                                                                                                                                    |                                                                  |
| <b>Languages necessary to complete the course:</b>                                                                                                                                                |                                                                  |
| <b>Notes:</b>                                                                                                                                                                                     |                                                                  |
| <b>Past grade distribution</b><br>Total number of evaluated students: 4                                                                                                                           |                                                                  |
| ABS                                                                                                                                                                                               | NEABS                                                            |
| 100,0                                                                                                                                                                                             | 0,0                                                              |
| <b>Lecturers:</b>                                                                                                                                                                                 |                                                                  |
| <b>Last change:</b> 02.06.2015                                                                                                                                                                    |                                                                  |
| <b>Approved by:</b>                                                                                                                                                                               |                                                                  |

## COURSE DESCRIPTION

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|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| <b>Academic year:</b> 2022/2023                                                                                                                                                                  |                                                                  |
| <b>University:</b> Comenius University Bratislava                                                                                                                                                |                                                                  |
| <b>Faculty:</b> Faculty of Mathematics, Physics and Informatics                                                                                                                                  |                                                                  |
| <b>Course ID:</b><br>FMFI.KJFB/3-FJF-801/15                                                                                                                                                      | <b>Course title:</b><br>Teaching Practice in the Winter Semester |
| <b>Educational activities:</b><br><b>Type of activities:</b> other<br><b>Number of hours:</b><br><b>per week:</b> 4 <b>per level/semester:</b> 52<br><b>Form of the course:</b> on-site learning |                                                                  |
| <b>Number of credits:</b> 8                                                                                                                                                                      |                                                                  |
| <b>Recommended semester:</b> 1.                                                                                                                                                                  |                                                                  |
| <b>Educational level:</b> III.                                                                                                                                                                   |                                                                  |
| <b>Prerequisites:</b>                                                                                                                                                                            |                                                                  |
| <b>Course requirements:</b>                                                                                                                                                                      |                                                                  |
| <b>Learning outcomes:</b>                                                                                                                                                                        |                                                                  |
| <b>Class syllabus:</b>                                                                                                                                                                           |                                                                  |
| <b>Recommended literature:</b>                                                                                                                                                                   |                                                                  |
| <b>Languages necessary to complete the course:</b>                                                                                                                                               |                                                                  |
| <b>Notes:</b>                                                                                                                                                                                    |                                                                  |
| <b>Past grade distribution</b><br>Total number of evaluated students: 6                                                                                                                          |                                                                  |
| ABS                                                                                                                                                                                              | NEABS                                                            |
| 100,0                                                                                                                                                                                            | 0,0                                                              |
| <b>Lecturers:</b>                                                                                                                                                                                |                                                                  |
| <b>Last change:</b> 02.06.2015                                                                                                                                                                   |                                                                  |
| <b>Approved by:</b>                                                                                                                                                                              |                                                                  |