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| **Title and Code** of the subject:  **Measurement technics and automatisation, MTBE7022A .** | **ECTS Credit Points: 5** |
| **Type** of the subject: **compulsory** / optional | |
| **Ratio of theory and practice: 50%/50%** (credit%) | |
| **Type and number of classes per semester**: 28 hour(s) lecture and 28 hour(s) practice per **semester**  Number of teaching hours / week : eg.:2+2 (lecture and practice) | |
| **Type of exam**: **exam** / practical course mark | |
| **Subject in the curriculum:** semester 4 | |
| Preliminary requirements:- | |

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| **Summary of content - theory**: |
| Course objectives:  **Schedule:**   1. Introduction of PLC: main internal parts, external modules. 2. Introduction to sensors and actuators: theory of operation. 3. Electrical wiring of PLCs – Source wiring with examples, theory. 4. Electrical wiring of PLCs – Sink with examples, theory. 5. Applied sensor technology: temperature, displacement, pressure. Theory of operation. 6. Applied actuator technology: pumps, valves, fans, mixers. Theory of operation. 7. Introduction to digital logic: basic logic gates. Theory. 8. PLC programming basics: implementation of basic logic. 9. PLC programming: timers: TON, TOF with examples. 10. PLC programming: counters and examples. 11. Introduction to PLC program development environment. 12. PLC program development: process design methods. 13. PLC program development: programming methods. 14. PLC program development: program verification methods. |
| **Summary of content - practice**: |
| **Schedule:**   1. Introduction of PLC: application examples. 2. Introduction to sensors and actuators: application examples. 3. Electrical wiring of PLCs – Source with examples, calculations. 4. Electrical wiring of PLCs – Sink with examples, calculations. 5. Applied sensor technology: temperature, displacement, pressure. Practical examples. 6. Applied actuator technology: pumps, valves, fans, mixers. Practical examples. 7. Introduction to digital logic: basic logic gates. Examples. 8. PLC programming basics: implementation of basic logic. Application examples. 9. PLC programming: timers: TON, TOF with examples. Application programming. 10. PLC programming: counters and examples. Application programming. 11. Introduction to PLC program development environment. Application programming. 12. PLC program development: process design examples. 13. PLC program development: programming examples. 14. PLC program development: program verification examples. |
| **Literature, handbooks in English** |
| 1. J. G. Webster “The Measurement, Instrumentation and Sensors handbook”, IEEE PRESS, 1999 2. Mitsubishi Electric, Structured Text (ST) Programming Guide Book, ST-GUID-E, http://dl.mitsubishielectric.com/dl/fa/document/manual/plc/sh080368e/sh080368eh.pdf 3. J. Karl-Heinz ed. “IEC 61131-3: Programming Industrial Automation Systems”, Springer, ISBN 978-3-642-12015-2 |
| **Competencies gained** *(acc. to the Regulation on training and outcome requirements)* |
| 1. **Knowledge:**  * xx * xx  1. **Skills:**  * xx * xx  1. **Attitude:**  * xx  1. **Autonomy and responsibility:**  * xx |

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| **Responsible lecturer: …………………….., ……………………..** |
| **Other lecturer(s): Dr. Szemes Péter Tamás, associate professor, DE-MK-MT** |

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| **Terms of course completion:** |
| 1. Submit Assignment: Development of industrial process control with PLC. The process should have minimum 5 operation steps, with minimum 10 sensors and 10 actuators.  Result: Process document and PLC program. |
| **Form of examination:** |
| Written and oral exam. |
| **Requirement(s) to get signature:** |
| Accepted assignment. |

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| **Exam questions:** |
| 1. Describe the internal architecture of PLC. 2. Why sensors and actuators are applied for industrial processes? 3. What is source wiring for sensors and actuators? 4. What is sink wiring for sensors and actuators. 5. How do temperature sensors work? 6. How do pumps work? 7. What are the basic logic gates? 8. How basic logic gates can be implemented in PLC? 9. How is time measured in PLC? 10. What are the fundamental features of a PLC IDE? 11. How are objects counted with PLC? 12. How is process designed with PLCs? 13. How is program structured for PLC? 14. How is a PLC program verified? |

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| **Title and Code** of the subject:  **Modern bioanalytical methods MTBE7018A** | **ECTS Credit Points: 3** |
| **Type** of the subject: compulsory | |
| **Ratio of theory and practice:**(credit%) 50 % theoretical, 50 % practical | |
| **Type and number of classes per semester**: 28 hour(s) lecture and 28 hour(s) practice per **semester**  Number of teaching hours / week : 1+2 (lecture and practice) | |
| **Type of exam**: practical course mark | |
| **Subject in the curriculum:** 4th semester | |
| Preliminary requirements:-MTBE7009A - Analytical chemistry | |

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| **Summary of content - theory**: |
| Course objectives: description of instruments and methods used in modern bioanalysis.  **Schedule:**   1. Techniques for Identifying Low-Food Compounds(UV-VIS, IR) 2. Determining Vitamins 3. Antioxidants and their Determination 4. Separation Technique (GC, HPLC) 5. Determine the sugars 6. Determination of fats and fatty acids 7. Mass Spectrometry (FAB / FIB, MALDI, API, MS) 8. Connected Analysis Methods (LC-MS, GC-MS, MS-MS) 9. Micro Extraction Techniques (SPME, LPME) 10. Definition of Proteins 11. Determination of Organic Micro-Contaminants 12. DNA, RNA 13. DNA, RNA 14. DNA, RNA |
| **Summary of content - practice**: |
| Skills to be learnt: the use of instruments and methods used in modern bioanalysis in practice.  **Schedule:**   1. Introduction of UV-VIS 2. Measurement with FRAP method 3. Measurement with DPPH method 4. Introduction of HPLC 5. Measurement of standards with HPLC 6. Measurement of sapmes with HPLC 7. Introduction of Mass Spectrometer 8. First practice test 9. Introduction of Micro Extraction Techniques (SPME, LPME) 10. Introduction of Proteins measurement methods 11. DNA, RNA 12. DNA, RNA 13. Second practice test |
| **Literature, handbooks in English** |
| Dr. Istvan Bak: Modern analytical techniques in the pharmaceutical- and bioanalysis (2011) |

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| **Competencies gained** *(acc. to the Regulation on training and outcome requirements)* |
| 1. **Knowledge**   Students learn about the basis of different methods, techniques and instruments.   1. **Ability**   Theoretical aspects of different methods, techniques and instruments, and their usage.   1. **Attitude:**   Student has a strong professional identity and professionalism that she/he can take for professional and wider social community.   1. **Autonomy and responsibility:**   Student sees the importance of modern bioanalytical methods knowledge so that he/she can formally incorporate into their further university studies and at the end of their studies. Students will be able to autonomously and responsibly use the knowledge acquired in the course of their work in a deliberate manner. |
| **Responsible lecturer: Gálné Dr. Remenyik Judit, senior research** |
| **Other lecturer:-** |
| **Terms of course completion:** |
| Completing assignments / exercises |
| **Form of examination:** |
| **written** (only if the subject is signed) |
| **Requirement(s) to get signature:** |
| Participation at practice is compulsory. Students must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Being late is counted as an absence. In case of further absences, a medical certificate needs to be presented. Missed practices should be made up for at a later date, being discussed with the tutor. |
| **Requirement(s) to get a grade:** |
| During the semester students have to write 2 theoratical and 1 practical tests. The minimum requirement for every mid-term and end-term tests is 50%. Based on the score of the tests separately, the grade for the tests is given according to the following table:  Score (%) Grade  0-49 fail (1)  50-65 pass (2)  66-74 satisfactory (3)  75-89 good (4)  90-100 excellent (5)  The student has to reach minimum 50% in every test. The sudent can take a retake test of the whole semester material twice. |