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| **Title and Code** of the subject:  **Theory of measurement and experimental design / MTMEL7001A** | **ECTS Credit Points: 5.** |
| **Type** of the subject: *compulsory* | |
| **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 : 2+2 (lecture and practice) | |
| **Type of exam**: exam | |
| **Subject in the curriculum:** semester 1. | |
| Preliminary requirements:- | |

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| **Summary of content - theory**: Successful food development and quality control is based on the proper application of theory of measurement and experimental design. The students will become familiar with the STEM (Science-Technology-Engineering-Mathematics)-specific professional culture specificities and values. They will also learn about the logics STEM-type research including the formulation of questions, definition of research object, elaboration and documentation of research activities, analysis of results, formulating the right conclusions and all these things together in the context of food development, quality control and food chain supply. |
| Course objectives:  1. The STEM- specific professional culture and values.  2-3. The STEM type of observation and research logics. The direct and indirect proofs type of research data.  4-5. Research publications types (report, case study, research and review papers, essay, power point presentation), and their content, scientific writing style, ethical considerations.  6-7. Measurement of fundamental and derived properties, data collecting and interpreting. Presenting numerical data. Dimensions, units and equations.  8-9. Macro- and microscopic measurement techniques: mass-, volume- and cell number determination.  10-11. Research planning and implementation: choosing the right object to study, sample size allocation and the statistic method, documentation of observations and hypothesis analysis.  12-13. Analysis of research data: descriptive statistics and correlation analysis; publication of numerical data.  14-15. Food industrial applications: development of novel food prototypes based on quantitative and qualitative parameters. The EFSA and FDA. |
| **Summary of content - practice**:  Successful food development and quality control is based on the proper application of theory of measurement and experimental design. The students will become familiar with the STEM (Science-Technology-Engineering-Mathematics)-specific professional culture specificities and values. They will practice the formulation of questions, definition of research object, elaboration and documentation of research activities, analysis of results, formulating the right conclusions and all these things together in the context of food development, quality control and food chain supply. |
| Skills to be learnt:     1. STEM specific informatics databases   2-3. Elaboration of research plans for food prototype development and quality assessment.  4-5. Scientific presentations and publications preparation based on the theoretical considerations related to the quality control of a developed food prototype.  6-7. Measurements based on calculi.  8-9. Determination of volume, mass and cell number in laboratory conditions.  10-13. Statistical analysis, problem solving.  14-15. Presentation of food prototype/quality concepts and evaluation. |
| **Literature, handbooks in English** |
| 1. Adams, D.S. (2003). Lab Math. A handbook of measurements, calculations and other quantitative skills for use at bench. Cold Spring Laboratory Press. Cold Spring Harbour, New York. ISBN 0-87969-634-6.  2. Davis, M. (1996). Scientific papers and presentations. Academic Press. San Diego, London. ISBN: 0-12-206370-8.  3. Lazic, Z. (2004). Design of experiments in chemical engineering. A practical guide. WILEY-VCH Verlag Gmbh, Wienhelm  4. Leedy, PD , Ormrod, JE (2015).Practical Research: Planning and Design, Enhanced Pearson eText -- Access Card (11th Edition). Pearson Ltd., ISBN-13: 978-0133747188  5. Gratzer, W. (2002). Eurekas and Euphorias. The Oxford book of scientific anecdotes. Oxford University Press, Oxford. ISBN: 0-19-280403-0 |
| **Competencies gained** *(acc. to the Regulation on training and outcome requirements)* |
| 1. **Knowledge:**  * Students will learn about the chosen profession related system of values, the STEM specific research activities main features and experimental design. * Student will be taught about the importance of model based research, and monitoring the dimensions of the food related phenomena, paying attention to the measurement accuracy and precision. * Students will know the features of scientific presentations, the importance of peer reviewed documentation, and the indirect versus direct proofs significance with respect to conclusion formulation.  1. **Skills:**  * Students will become capable of formulating STEM specific questions and elaborating research projects, and addressing the identified issues through proper methods. * Students will acquire knowledge to carry out measurements specific to food manufacturing and safety. * Committed to food R & D & I activities  1. **Attitude:**  * Students will become aware of the importance of the STEM research properties, planning, data acquisition and analysis, drawing conclusions and formulating the prospective features of performed research activity. * Students will show a deep understanding of the role and purpose of R & D & I in the food industry.  1. **Autonomy and responsibility:**  * Committed to food quality, safety, and environmental friendly and sustainable solutions that support the health of the individuals, the society and bioeconomy. |

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| **Responsible lecturer: Dr. Endre Máthé PhD** |
| **Other lecturer(s): -** |

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| **Terms of course completion:** |
| 1. 2 essays on given topic 2. 2 presentations on given topic 3. Elaboration of a health-promoting food prototype proof of concept |
| **Form of examination:** |
| Written and oral exam |
| **Requirement(s) to get signature:** |
| Submission of 2 essays, and the food prototype proof of concept  Attendance at lectures is recommended, but not compulsory. 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. Attendance at practice classes will be recorded. 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 lecturer. Active participation is evaluated by the teacher. |

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| **Exam questions:** |
| 1. What are the main features of the STEM-specific professional culture and values? 2. What are the main characteristics of the STEM-specific research logics? 3. What are the basic dimensions associated with food? 4. How could the accuracy and precision of measurement be defined? 5. How do we record and report measurement data? 6. How are research conclusions formulated? 7. What are the main features of the scientific publications like report, case study, research and review papers, essay, powerpoint presentation? |