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| **Title and Code** of the subject: **Food Physics** MTBE7003A | **ECTS Credit Points: 4** |
| **Type** of the subject: **compulsory** | |
| **Ratio of theory and practice** (credit%) 50 % theoretical, 50 % practical | |
| **Type and number of classes per semester**: 28 hours lecture and 28 hours practice per **semester**  Number of teaching hours per week : 2+2 (lecture and practice) | |
| **Type of exam**: **colloquium** | |
| **Subject in the curriculum**: **1st semester.** | |
| **Preliminary requirements:****none** | |

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| **Summary of content - theory**: |
| Course objectives:  Acquisition of the physical bases of the processes that determine the production and quality assurance of foods and raw materials, their scientific foundation, and the understanding of the physical bases. Developing skills to accommodate new knowledge.  Education of selected food physical knowledge, grounding of further studies, and the foundation of related primer and subject areas.  Schedule:  1st week: Structure, composition and contents of subject Food Physics. Basic knowledges: systems and environment, phases, components. Dimensions and prefixes.  2nd week: Physical characterisation of water. Functions of water in biological systems. Water content of different ground materials of foods. Definition of phenomenon water activity. Connections between food’s water activity and shelf life.  3rd week: Sorption studies: definition of absorption, adsorption, biosorption, desorption, adsorbent, adsorptivum, adsorbatum, adsorption capacity, adsorption saturation, liophile adsorbent, liophobe adsorbent, liosorption, chemosorption.  4th week: Definitions of mass and density. Density influencing factors. Connection between density and particle size in the case of solid stages.  5th week:Solid state. Crystal grid types and errors. Solutions, solubility. Hydration heat, dissolving heat. Liquid state, surface tension, critical parameters. Vapour tension. Gaseous stage, ideal and realistic gases, gas laws.  6th week: Rheological properties – elasticity, plasticity and flow behaviours. Influencing factors: temperature, pressure. Energy and time demand at the flowing of elastic and plastic systems. Tixotripy, changing of movement characteristics.  7th week: Phenomenon of surface tension of fluids: reason, definition, dimension, measurement methods.  8th week: Definition, measurement methods and calculation of permeability of plain sheet shape materials.  9th week: Thermal properties. Temperature scales: Celsius, Fahrenheit and Kalvin. Calorimetry, measuring the potential energy level of foods. Basic principles of thermodynamic. Physical and energetic background of operation of refrigerators and deep freezers. Using the heat energy of the freezer’s warm side.  10th week: Caloric values of foods. Thermal analysis of different foods: TA, DTA, TG and DTG methods and evaluation of the diagrams.  11th week: Electronical and electrical properties. Electro conductivity, capacity and electrolity solutions. Operations of galvanic elements and batteries. Redox systems, redox potential and their role in foods. Local elements and their use in corrosion protection.  12th week: Magnetic properties: diamagnetic, paramagnetic and ferromagnetic characters. Nuclear magnetic resonance and its analytical use for foods.  13th week: Optical properties of systems. Refraction index, colorimetry. Light absorption of solvents.  14th week: Basic knowledges of radioactivity. Alpha, beta and gamma radiations. Generating of X-ray radiation. Energy of radioactive radiations, ionizing radiations. Irradiation of foods by ionizing radiations. |
| **Summary of content - practice**: |
| Skills to be learnt:  Deeping the theoretical knowledges by solving some practical exercises. To get adequate skills of discussing the lecture’s material. Basic practical knowledges on the really wide range of possibilities of Food Physics.  **Schedule:**  1st week: Possible connections between systems and environment: open, closed and isolated systems. Homogenous, heterogenous and inhomogenous systems. Categorising of living organisms by the given aspects  2nd week: Methods for calculation of food’s water activity values. Connections between food’s water activity and shelf life.  3rd week: Comparing of existing adsorption models: Freundlich, Langmuir and BET models, theoretical and practical differences of the models. Absorption and adsorption influenced by temperature, pressure and solution concentration. Using adsorption and subsequent adsorption for separation of components.  4th week: Calculation of density by systems in different phases. The main density influencing factors.  5th week: Phase parameters: volume, pressure, temperature. Energy level modification during phase change. Phase diagram of water and dilute solutions.  6th week: Comparison of rigid, elastic and plastic rheological stages. Changes of energy demand for moving of plastic systems.  7th week: Importance of surface tension of liquid stage foods, fruit juices and alcohol containing beverages.  8th week: Permeability calculations for different food packaging materials. Permeability influencing during the production of packaging materials.  9th week: Physical, chemical and phase transition heats. Enthropy, enthalpy – definitions and demonstrations. Procedure direction influencing factors.  10th week: Calorimetric calculations of foods digestion, usable energy, digestion energy and sum of energy. Energy efficiency.  11th week: Electrical conductivity calculations of electrolyte solutions: phenomenon of eletrolytical dissociations.  12th week: Demonstration of diamagnetic, paramagnetic and ferromagnetic characters of systems – their usability in the practice  13th week: Analysis with the measurements of UV, VIS and IR light absorption spectrum. Lambert-Beer’s low.  14th week: Using of ionizing gamma and X-ray radiations for the shelf-life extension of foodstuffs. Acceptance of this method by the wide range of the food consuming populations. |
| ***Compulsory literature:***  Figura, L.O. – Teixeria, A.A. (2007): Food Physics. Physical properties – Measurement and Application. Springer Verlag, Berlin-Heidelberg-New York. ISBN-13: 978-3-540-34191-8  ***Optional literature:***  Figura, L.O. (2004): Lebensmittelphysik. Physikalische Kenngrößen – Messung und Anwendung. Springer Verlag, Berlin-Heidelberg-New York. ISBN-10: 3-540-20337-0 |
| **Competencies gained** *(acc. to the Regulation on training and outcome requirements)* |
| 1. **Knowledge**   Students learn about the general and specific characteristics of food physics, their boundaries, their directions of development, and their attachment to related subjects. Students know the usability of basic Food Physics in their own profession.   1. **Ability**   Physical theories and related terminologies can be used in innovative ways to solve the actual problems of food processing.   1. **Attitude:**   The student has a strong professional identity and professionalism that she/he can take for professional and wider social community.   1. **Autonomy and responsibility:**   Students see the importance of food physical knowledge so that it can formally incorporate in related primer and subject matter into further 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. |

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| **Responsible lecturer:**  **Assoc. Professor Dr. habil. Imre Vágó, CSc, deputy head of Institute** |
| **Other lecturer:-** |
| **Form of examination:**  **Oral and/or written** (only if the practice is signed) |
| **Requirement(s) to get signature:**  Attendance at lectures is not compulsory, but highly recommended!  As an individual activity, all of the students have to complete and present to the other students two power point presentations. The theme of it will be jointly decided by the student and the lecturer. Form and content of presentations will be discussed by the group members, and will be accepted or denied. The denied presentation must be repeated. Requirement to get signature is two accepted .ppt-presentations. |