Food Engineer MSc Final Exam II.
Differential vocational learning
Food Process Design Specialization
2022 January

1. Open loop control (time-dependent, condition-dependent, following), pneumatic, electronic and mixed systems, applications.
2. Design of the Process Control systems. PLC-s: setup, functional elements, applications. Closed Loop Control with PLC.
3. Investigation of the automatic control systems; identification-analysis-synthesis. Experimental and differential equation-based description.
4. Time-domain to frequency-domain or operator-domain transformations; properties and rules of Fourier and Laplace transform. Transfer function.
5. Stability of the control systems, Nyquist and Bode diagrams. Signal conditioning with P, I, D members, tuning.
6. Actuators (electric, mechanic, pneumatic or hydraulic output), properties and applications
7. Error assessment, uncertainty propagation. Calculation of measurement errors of multicomponent systems. Present the method with an example.
8. Application of machine vision systems (VIS, NIR) in the food industry. Characterization of the color, shape and pattern properties. Multi- and hyperspectral systems. Evaluation methods.
9. Statistical assessment of the measurement results (regression analysis, variance analysis, classification). Multivariate methods for modeling and qualification.
10. Design of Experiments. OFAT (One Factor At a Time) and Factorial Designs – construction, properties, application fields.

11. Steady-state process design (flow-sheeting, split-fraction concept, solving systems of linear and nonlinear equations) and modeling of process dynamics (initial value problems)
12. Classification and basic elements of optimization tasks. Formulation of mixed integer nonlinear optimization problem (MINLP) and linear programming (LP).
13. Significance and Economy of Membrane Filtration Processes.
14. Mass Transfer Membrane Processes, Theory, Modelling and Application of Pervaporation in Food Industry. Membrane Contactors.
15. Non-Steady State Heat Transfer in Solids and Liquids. Applied Dimensionless Criteria.
16. Principles of Absorption, Characteristics of Phase Equilibria, Gas Solubility, Two Film Theory, Design of Packed Column.
17. Batch and Continuous Distillation, Balance Equations and Operation Modes.
18. Batch and Continuous Rectification. Balance Equations and Operation Modes.
19. Advantages of Computer Modelling of Food Processing Technologies, Basic Principles and Tools of Design. The Characteristics of Super Pro Designer Software and Application Possibilities.
20. Novel food engineering unit operations

Budapest, 2022