BME, Faculty of Chemical Technology and Biotechnology,
Department of Chemical and Environmental Process Engineering
BSc, Full time training
Final exam items
January 2024

Computer Process Control - Environmentally benign chemical processes

1. What is a PID controller? What PID algorithms do you know? What are the P, I, and D? How can the parameters of P and I be defined? In particular, for which PID algorithms and for which parameters can the IMC/Lambda and Cohen-Coon methods be applied?
2. Briefly describe the problem of integral windup and low-pass filters often used in derivative parts and their importance for the quality of control.
3. What special hardware elements are used in computer process control? Draw and explain the block diagram and explanation of DDC.
4. Describe the importance of Laplace and Z-transforms and their relationship with sampling time. How would you choose a sampling frequency for sampled systems?
5. In an industrial control system, the parameters of a PID controller are left at default values. How would you tune this controller? Can you feed in the calculated parameters without further attention?
6. Control of MIMO systems: how would you pair MV and PV values? Describe the main steps in the application of RGA, including the calculation of RGA for a real system.
7. What is meant by MIMO systems? Why is the degree of freedom analysis of MIMO systems important? Describe an arbitrary method for degree of freedom analysis.
8. Purification of industrial wastewater. Classification of available methods based on the properties of the contaminants.
9. Wet air oxidation: technological solutions, typical applications. Supercritical water oxidation. Comparison of these two technologies.
10. Sublimation. Batch and continuous processes (with technological flow charts). Applications. Basics of lyophilization and its applications.
11. Importance of residence time distribution for concentration of heat-sensitive materials. Comparison of atmospheric and vacuum distillation /evaporation processes. Introduction of short path distillation and molecular distillation compared to wiped-film evaporator. Applications and engineering challenges.

12. Classification of membrane processes based on driving force. Balance equations, typical membrane modules. Batch, semi-continuous, and continuous processes with flow charts.
13. Distillation under pressure (reasons for the application of vacuum, with consequences). Pressure swing distillation (minimal or maximal boiling point azeotropes). Explain them with flow charts of distillation sequences along with the equilibrium curves.
14. Biofuels. Compare biodiesel, biogas and bioethanol (raw materials, production technologies, applications).