Puu-0.4400
Environmental Engineering 1: Mechanical, Physical and Chemical Treatment Processes (5 cr)
Puu-0.3330 Environmental Engineering (6 cr, theory part 1)
Exam 19.12.2012

Brief answers are sufficient.

All students:

1. (20 %) Analytics: Which analytic parameters are used to characterize organic pollution in water? What is their analytic meaning and what kind of organic matter they distinguish?

2. (20%) Settling. a) Explain the key points of the discrete particle settling theory. Which parameter determines the required particle residence time in a settling tank?
b) Which 4 types of the settling behaviour are distinguished in a settling tank, based on the concentration and the morphology of the particles?

3. (20 %) Filtration. a) Describe the main mechanisms of the removal of suspended and colloid particles in water filtration through the grain medium.
b) Describe the main mechanisms of aerosol particle deposition on a collecting surface of *e.g.* a single fibre or a spherical water drop.
What serves as the actual dust collector in an industrial fabric filter?
c) Which particle sizes present the main difficulty for the removal of particles from water and from air? Explain why.

4. (20%) Aggregation. What is the purpose of the aggregation of particles in environmental technology? Describe the mechanisms of coagulation and flocculation operating in wastewater treatment.
Which species are employed as coagulants in wastewater treatment? Explain the Schulze-Hardy rule.
Highlight the role of stirring (mixing) in coagulation and flocculation.

5. (20%) Particles removal from gas: Describe the principles of particles removal with an electrostatic precipitator and with a cyclone. What are the most important factors affecting the removal efficiency?

6. Extra points (10%) Advanced oxidation: Describe the main idea of advanced oxidation methods. What serves as an actual oxidizing agent?

Major students only:

Puu-0.4400

Environmental Engineering 1: Mechanical, Physical and Chemical Treatment Processes (5 cr)

Engineering calculation

Answer one of the following questions:

1. Settling: Which key parameters would be needed to design of a Primary Sedimentation Basin?

2. Ion-exchange process: How would you approach to determine the capacity of a cation-exchange resin?

3. Analysis of activated carbon adsorption data: How would you proceed to determine the Freundlich isotherm coefficients?

4. Membrane methods: Which factors would you consider for determination of membrane area required for water demineralization with reversed osmosis?

5. Cyclone: What are the main operating parameters in removal of particles with a cyclone?