Faculty of Technology and Science
Environmental and Energy Systems

Syllabus

Course Approval
The syllabus was approved by the Faculty Board of Technology and Science on 3 September 2008, and is valid from the Spring semester of 2008 at Karlstad University.

Course Code: EMGB13
Cleaning technologies, 15 ECTS Credits
(Reningsteknik, 15 Swedish credit points)
Degree Level: Bachelor
Progression Level: B

Language of Instruction
Swedish

Prerequisites
Environmental and Energy Engineering, 30 ECTS Credits, or the equivalent.

Major Field of Study
Environmental and Energy Systems

Learning Outcomes

General aims:
Students should
- understand the principles of cleaning technology and be able to use cleaning-technological processes
- use established engineering methods to solve problems of cleaning technology
- be able to read, comprehend, and summarize the scientific literature of the field
- give an account of and understand various transport processes and separation methods
- work with cleaning-technological issues from a sustainability perspective.

Upon completion of the course, students should be able to:
- give an account of various sludge-processing methods
- give an account of the anaerobic digestion process and estimate the energy balance of an anaerobic digester
- give an account of chemical precipitation and flocculation and which types of pollutions that can be reduced
- give an account of various types of mechanical separation
- give an account of different air diffusers and their function
- give a general account of the types of organisms that can be found in biological cleaning plants and what properties make them useful
- demonstrate familiarity with existent aerobic and anaerobic biological processes, their differences, and which conditions must be met in order for them to function (Examples of biological processes: active sludge, biofilm, nitrogen and phosphorous reductive.)
- estimate flow balances
- estimate mass balances for water, organic material (C), and nutrients (N and P)
- estimate the need for nutrients and oxygen
- estimate the energy required for air diffusion

- estimate the size of sedimentation pools.

For the special area of gas, students should be able to:
- give an account of methods for gas cleaning and the basic differences between them
- propose suitable cleaning methods for specific problems.

For the special area of soil remediation, students should be able to:
- give an account of how to conduct a site assessment and its component parts
- propose different methods of soil remediation and give adequate motivations for their use.

For the special area of water, students should be able to:
- give an an account of methods for purification of drinking water, municipal sewage water, and industrial waste water
- determine which purification method is best suited for the purpose and dimension a plant, taking volumes and stop times into account, for a given type of water
- give an account of the criteria for the selected method of purification, such as temperature, pH, etc.
- estimate the energy requirements for the selected purification method.

Content and Form of Instruction

Contents:
Water purification, gas cleaning, and soil remediation, with special emphasis on water purification.
For the segments on soil remediation and gas cleaning, the focus is on processes/theory.
For the segment on water purification, the focus is on processes and intensive studies of technology, energy, and modeling.

Theories of:
- Transport processes
- Conversion processes
- Removal processes

Instruction is in the form of lectures, laboratory assignments, and specialized assignments and projects (individual).

Reading List

See separate document.

Examination

The grades are based on two exams. In addition the students must pass laboratory reports and hand-in assignments.

Grades

One of the grades Fail, 3 (Pass), 4 (Some Distinction), or 5 (Distinction) is awarded in the examination of the course.

Quality Assurance

Follow-up relating to learning conditions and goal-fulfilment takes place both during and upon completion of the course in order to ensure continuous improvement. Course assessment is based on student views and experiences as reported in written course evaluations and/or group discussions. Students will be informed of the result of the evaluation and of the measures to be taken.

Course Certificate

A course certificate will be provided upon request.

Additional Information

Students who enrolled before 1 July 2007 will complete their studies in accordance with the requirements of the earlier admission. Upon completion students may request degree and course certificates to be issued under the current ordinance if they meet its requirements.

The local regulations for studies at the Bachelor's and Master's levels at Karlstad University, ref. C2007/368, stipulate the obligations and rights of students and staff.

Karlstads universitet 651 88 Karlstad, Sweden
Tel +46-54-700 10 00 Fax +46-54-700 14 60
information@kau.se www.kau.se