Faculty of Health, Science and Technology
Chemical Engineering

Syllabus

Forest bioeconomy - processes, energy and products

Course Code:	KTAD04
Course Title:	Forest bioeconomy - processes, energy and products *Skoglig bioekonomi - processer, energi och produkter*
Credits:	15
Degree Level:	Master's level
Progressive Specialisation:	Second cycle, has only first-cycle course/s as entry requirements (A1N)

Major Field of Study:
KTA (Chemical Engineering)
MEI (Environmental and Energy Systems)

Course Approval
The syllabus was approved by the Faculty of Health, Science and Technology 2026-01-21, and is valid from the Autumn semester 2026 at Karlstad University.

Prerequisites
Registered for 170 credits in the Master of Science Programme in Chemical Engineering or Industrial Management, with 30 credits in Chemistry and 30 credits in Chemical Engineering completed, including Separation processes, or registered for 60 credits in Chemistry with 30 credits completed and 90 credits in Chemical Engineering with 45 credits completed. In addition, upper secondary level Swedish 3 or Swedish as a second language 3 and English 6, or Swedish level 3 or Swedish as second language level 3, and English level 2.
An equivalence assessment can be made.

Learning Outcomes
The aim of the course is for students to acquire in-depth knowledge of the structure of biomass, bioenergy, and existing and emergent forest industry processes.

Upon completion of the course students should be able to:
- explain the concept of bioeconomy and give an account of different perspectives on the forest as an ecosystem and a resource,
- give an account of sustainability aspects of industrial processes for biomass from a life-cycle perspective,
- give an account of the structure of wood in terms of its macro-molecular components,
- explain and give examples of bioindustrial processes,
- give an account of and explain selected unit operations within the area of bioindustrial processes, and
- plan, carry out, and present independent work in the form of project and laboratory assignments, both in writing and orally, within given time frames.

Content
The course covers the following:
- The concepts of bioeconomy and circularity
- The forest as a provider of ecosystem services, including biomass
- Forest biodiversity
- Conflicts of interest in sustainable land use
- Foundations of environmental ethics
- Policy instruments in bioeconomy

- Forestry and harvesting techniques
- Resource management in industrial processes
- The development of biomass from the perspective of evolution
- Wood and fibre morphology
- The chemical structure of biomass
- The environmental impact of forest industry processes

The course also provides process and systems knowledge applicable to industrial operations, such as:
- Sawmilling
- Wooden construction
- Mechanical and chemical pulp production
- Paper production technology
- Solid biofuels
- Drying technology
- Biorefineries
- New materials and processes
- Selected unit operations in bioindustrial processes, based on fundamental chemical engineering processes

Laboratory sessions are included, plus a project in which students engage in in-depth study of a research question related to the concept of bioeconomy.

Reading List
See separate document.

Examination
Assessment is based on:
- Active participation in seminars (1.5 cr)
- Laboratory work (1.5 cr)
- An individual written exam (7.5 cr)
- Written and oral project presentations (4.5 cr)

If students have a decision from Karlstad University entitling them to Targeted Study Support due to a documented disability, the examiner has the right to give such students an adapted examination or to examine them in a different manner.

Grades
One of the grades Pass with Distinction (VG), Pass (G), or Fail (U) is awarded in the examination of the course. Engineering students are awarded one of the grades Pass with Distinction (5), Pass with Credit (4), Pass (3), or Fail (U).

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 evaluation is partly based on student views and experiences obtained in accordance with current regulations and partly on other data and documentation. Students will be informed of the result of the evaluation and of any measures to be taken.

Course Certificate
A course certificate will be provided upon request.

Additional information
The local regulations for studies at the Bachelor and Master levels at Karlstad University stipulate the obligations and rights of students and staff.