Reg No: EMAD27/20221

Faculty of Health, Science and Technology
Environmental and Energy Systems

Syllabus

Methods for sustainability assessment

Course Code:	EMAD27
Course Title:	Methods for sustainability assessment *Teknik för hållbarhetsbedömning*
Credits:	10
Degree Level:	Master's level
Progressive Specialisation:	Second cycle, has only first-cycle course/s as entry requirements (A1N)

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

Course Approval
The syllabus was approved by the Faculty of Health, Science and Technology 2021-09-08, and is valid from the Spring semester 2022 at Karlstad University.

Prerequisites
Upper secondary level Swedish 3 or Swedish as a second language 3 and English 6

Programme students: 75 ECTS credits of completed courses in the Energy and environmental engineering programme (Bachelor or Master) or admission to the Master programme in Energy and environmental engineering towards a Master degree

Non-programme students: 90 ECTS credits of completed courses, including at least 15 ECTS credits in energy engineering and at least 15 ECTS credits in mathematics, or equivalent

Learning Outcomes
Upon completion of the course, students should be able to:
- identify and follow flows of materials and substances in the earth's ecospheres and anthroposphere,

- analyse different systems regarding environmental impact and various perspectives on economic feasibility and social impact by applying LCA (Life Cycle Analysis), MFA (Materials Flow Analysis), LCCA (Life Cycle Cost Analysis), and S-LCA (Social Lifecycle Analysis),
- analyse the components of an anthropogenic system to aggregate and understand the whole system,
- analyse problems and solutions in the area of engineering for sustainable development from different perspectives, and
- carry out a project in the area of engineering for sustainable development by defining research questions, collecting relevant information, analysing and communicating results according to instructions.

Content
Module I Environmental assessment:
(a) Materials Flow Analysis (MFA)
1. Analysis, evaluation and design of anthropogenic systems (companies, cities, countries, the world)
2. Use materials flow analysis to:
- predict changes in the system regarding demand and emissions
- interpret changes regarding the consequences for the environment, resource protection, employment rate or geopolitical conditions
- identify possibilities to change systems in the desired direction
3. Terminologies of system definition, choice of indicators, vulnerability analysis, data harmonisation, dynamic modelling
4. MFA as precursor to LCA (Life Cycle Analysis)

b) Life Cycle Analysis (LCA)
1. Modelling of different environmental effects of products and services (for example climate change, toxicity, land use, and so on)
2. Use of different methods for environmental assessment

Module II Socioeconomic analysis:
(a) Life Cycle Cost Analysis (LCCA)
1. Cost categories, income categories, current value calculations, discounts and their importance
2. Differences in setting repayment periods pertaining to projects based on current value, introducing environment costs to integrate environmental and economic aspects in decision-making

(b) Social Life Cycle Analysis (S-LCA)
1. Introduction to S-LCA methodology
2. Criteria and indicators
3. Case studies in the literature

Module III Group project:
Students apply the theories of the first two modules and work in groups with an assigned project. Project content can be adjusted to departmental research, industrial examples or students' own choices.

Reading List
See separate document.

Examination
Each module is assessed separately.
- Written hand-in assignments and presentation (Module I)
- Written exam (Module II)

- Written report of the group project (Module III)

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