Reg No: EMGB21/20252

Faculty of Health, Science and Technology
Environmental and Energy Systems

Syllabus

Computational Methods and Programming in Energy Technology

Course Code:	EMGB21
Course Title:	Computational Methods and Programming in Energy Technology *Beräkningsmetoder och programmering inom energiteknik*
Credits:	7.5
Degree Level:	Undergraduate level
Progressive Specialisation:	First cycle, has less than 60 credits in first-cycle course/s as entry requirements (G1F)

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

Course Approval
The syllabus was approved by the Faculty of Health, Science and Technology 2025-02-19, and is valid from the Autumn semester 2025 at Karlstad University.

Prerequisites
Registered for 45 ECTS credits in the Master programme in Energy and Environmental Engineering, with 7.5 ECTS credits completed in Mathematics

Learning Outcomes
The aim of the course is for students to develop and apply basic knowledge in the areas of fluid mechanics, applied thermodynamics, and heat and mass transfer using a programming language to solve more complex problems. Students are also expected to widen and deepen their knowledge base with facts and develop skills in using standard problem-solution methods and systems analysis for energy engineering systems.

Upon completion of the course, students should be able to:
- apply basic knowledge of heat and mass transfer, thermodynamics, and fluid mechanics to design components in energy engineering systems,
- apply a programming tool for graphical data processing and managing data sets in the form of vectors and matrices,
- develop and implement simple algorithms to automate calculations,
- interpret, describe, and design energy engineering systems using a programming language,
- identify and describe constants and variables in energy engineering systems,
- simulate fundamental combustion and gasification reactions,
- apply and evaluate regression models to characterise variables and analyse systems,
- apply basic statistical methods to assess data and analyse results, and
- present results in writing in accordance with scientific conventions.

Content
Students work individually and in groups with project tasks which are presented orally and in writing.

The course covers the following:
- building and developing scripts in a programming language
- presentation of technical results using figures and diagrams
- measures of central tendency such as mean, median, and mode
- measures of dispersion such as variance and standard deviation
- estimation of results using confidence intervals
- design and analysis of combustion processes in combined heat and power plants
- design of heat exchangers and heat pumps
- design of renewable energy systems
- regression analyses

Reading List
See separate document.

Examination
Assessment is based on hand-in assignments, oral presentations, and a written exam.

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 (5) Pass with Some Distinction (4), Pass (3) or Fail (U) 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.