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 12 March 2014 , and is valid from the Spring semester of 2014 at Karlstad University.

Course Code: EMGA93
Energy Engineering, 7.5 ECTS Credits
(Energiteknik, 7.5 Swedish credit points)
Degree Level: Bachelor
Progressive Specialisation: G1N (First cycle, has only upper-secondary level entry requirements)

Language of Instruction
Swedish

Prerequisites
Upper secondary level Mathematics D, Physics B, and Chemistry A (field-specific eligibility 8) or Mathematics 3c, Physics 2 and Chemistry 1 (field-specific eligibility A8).

Major Field of Study
MEI (Environmental and Energy Systems)

Learning Outcomes

The aim of the course is to provide basic methods and concepts of energy engineering, and to give an orientation in central aspects of energy systems. The course also aims to widen and deepen the students' understanding of the field of energy with factual knowledge. The course will provide central and basic knowledge of energy engineering, but not to provide specialized competence.

The course consists of two modules with the following specific aims:

Upon completion of module 1, Combustion and Thermodynamics, students should be able to:
- give an account of the Swedish energy system as regards supply, conversion, and use of energy
- give an account of the renewable energy sources presently in use
- explain the concepts thermal value, excess air coefficient, heat conduit, radiation, convection, k-value, U-value, and coefficients of performance
- describe the stoking devices for different types of boilers for energy conversion purposes
- estimate heat transfer through plane and circular layers
- estimate the excess of air, formation of carbon dioxide, amount of flue gas, flue gas temperature, and the degree of efficiency during combustion
- describe the function of compressor powered facilities with pumps for refrigeration, freezing, or heating
- estimate cooling and heating efficiency of facilities with pumps for refrigeration, freezing, or heating.

Upon completion of module 2, Fluid Mechanics, students should be able to:
- explain the concepts of static, dynamic, and total pressure
- interpret and apply the continuity equation and Bernoulli's equation in calculations

- give an account of the validity of Bernoulli's equation
- describe various methods to measure the pressure and flow of fluids
- estimate the pressure drop in basic tube and canal systems
- dimension a pump and a fan for basic tube and canal systems
- describe various types of applied heat transfer, such as heat exchangers, and be able to apply the basic calculation methods for heat exchangers
- explain the concepts system, system limits, and degree of efficiency for the applications of energy engineering that are covered in the course
- list the mass-, power-, and energy balances for systems
- explain the difference between power and energy.

Content and Form of Instruction

The course is based on lectures with related classes as well as a form support classes. There will also be laboratory assignments that are conducted in groups.

Course content:
Energy problems that engineers will encounter. Energy and power balances. Energy analysis. Future energy sources and energy carriers. Renewable energy production. The Swedish energy system.

Concepts: System limits, pressure concepts, continuity equations, Bernoulli's equation. Thermodynamic concepts, heat transfer, thermodynamic processes. Refrigeration and heat pump facilities. Hydraulic machinery, especially turbo pumps. Fuels and combustion.

The course comprises the following modules:

Module 1: Combustion and Thermodynamics, 4 ECTS Credits
Module 2: Fluid Mechanics, 3.5 ECTS Credits

Reading List

See separate document.

Examination

Each module is assessed separately.

For each module, assessment is based on a written individual exam.

To earn a Pass grade for the course, both modules must be completed satisfactorily.
To earn a Pass grade for a module, a minimum score of 50% must be achieved in the exam.

Grades

One of the grades Fail (U), Pass (3), Some Distinction (4), or Distinction (5) 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 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