Faculty of Health, Science and Technology
Environmental and Energy Systems

Syllabus

Applied Thermodynamics

Course Code:	EMGA77
Course Title:	Applied Thermodynamics
	Tillämpad termodynamik
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:
KTA (Chemical Engineering)
MEI (Environmental and Energy Systems)
MTA (Mechanical Engineering)

Course Approval
The syllabus was approved by the Faculty of Health, Science and Technology 2017-09-13, and is valid from the Spring semester 2018 at Karlstad University.

Prerequisites
Basic Mathematics 7.5 ECTS cr and Calculation in One Variable 7.5 ECTS cr, or equivalent

Learning Outcomes
The aim of the course is that students acquire basic knowledge of energy engineering concepts and methods, and develop skills in problem solving in applied thermodynamics.

Upon completion of the module, students should be able to:
- set up energy and massbalance for open and closed systems, such as pump systems and working cylinders,
- give an account of the potentials and limitations of energy conversions and relate these to effect degree,
- give an account of the concept thermodynamic equilibrium,
- use the equation of state for ideal gases,
- give an account of the properties of real gases,
- give an account of the importance of conversion between the different phases of substances,
- interpret and use the effectiveness in connection with energy conversion,
- analyse closed and open systems in relation to the effectiveness of heaters,
- calculate the received and lost work and heat for a system,
- give an account of the entropy concept and its importance to the economising with energy quality,
- give an account of thermodynamic cyclic processes, gas/steam cycle and the cooling process,
- give an account of the function of compressor driven fridge, freezer and heating pump installations,

- calculate the machine effect of the Otto, Diesel and Stirling engines,
- calculate the heat and cold factors for fridge, freezer and heating pump processes,
- analyse electricity effect, condenser effect and received heater effect for a Rankine cycle.

Content
Insgtruction is in the form of lectures and classes as well as lab session opportunities.

The course comprises:
- temperature concept
- energy conversion
- thermodynamic theorems
- properties of pure substances
- ideal and real gases
- conversion between different phases of substances
- closed and open systems
- enthalpy concept
- entropy concept
- probability distribution
- thermodynamic cycles
- heat pumps
- gas- and steam power processes, e.g. Otto and Diesel engines, Sterling engine and Rankine cycle
- cooling processes
- state functions
- thermodynamic equilibrium
- reversible and irreversible processes
- thermodynamic potentials
- absorption plants

Reading List
See separate document.

Examination
Assessment is based on a written exam.

Grades
One of the grades 5 (Distinction), 4 (Some Distinction), 3 Pass , 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 course EMGA70 cannot be included in the same degree programme as the course EMGA77.

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