Faculty of Health, Science and Technology
Environmental and Energy Systems

Syllabus

Technical thermal dynamics

Course Code:	EMGA91
Course Title:	Technical thermal dynamics *Teknisk 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:
MEI (Environmental and Energy Systems)
MTA (Mechanical Engineering)

Course Approval
The syllabus was approved by the Faculty of Health, Science and Technology 2018-08-27, and is valid from the Spring semester 2019 at Karlstad University.

Prerequisites
Mathematics for engineers 15 ECTS credits or admission to the mechanical engineering programme, or equivalent.

Learning Outcomes
The aim of the course is that students acquire basic knowledge of energy engineering concepts and methods. Students develop skills in solving applied thermal dynamics problems.

Upon completion of the course, students should be able to:
- set up energy and mass balances for open and closed systems, such as pump systems and working cylinders,
- give an account of possibilities and limitations in energy transformations, expressed in terms of thermodynamic main theorems,
- interpret and use efficiency in connection with endergy transformation,
- give an account of the equilibrium concept,
- use state equations for ideal gases,
- give an account of the propertieds of real gases,
- give an account of the importance of conversions between the different phases of substances,
- analyse closed and open systems in terms of efficiency of heat engines,
- calculate added or delivered energy and heat for a system,
- give an account of the entropy concept,
- give an account of thermodynamic circuit processes, the gas, steam and cooling process,
- give an account of the function in compressor-driven cooling, freezing and heat pump installations,
- calculate the effect of an Otto-, Diesel- and Stirling engine,

- calculate heat and cold factors of cooling, freezing and heat pump processes,
- calculate added boiler effect to a Rankine cycle.

Content
Instruction is in the form of lectures and exercises as well as laboratory sessions.
The course comprises the following components:
- the temperature concept
- energy conversions
- thermodynamic main theorems
- properties of pure substances
- ideal and real gases
- conversions between substance phases
- closed and open systems
- enthalpy concept
- entropy concept
- thermodynamic circuit processes
- heat pumps
- gas and steam processes, e.g. Otto- and Diesel engine, Sterling engine and Rankine cycle cooling processes
- state functions
- thermodynamic equilibrium
- reversible and irreversible processes
- thermodynamic potentials
- absorption installations

Reading List
See separate document.

Examination
Assessment is based on a written exam.

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

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.