Faculty of Health, Science and Technology
Environmental and Energy Systems

Syllabus

Thermal fluid sciences

Course Code:	EMGA76
Course Title:	Thermal fluid sciences *Värme och strömningslära*
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 2017-03-07, and is valid from the Autumn semester 2017 at Karlstad University.

Prerequisites
Basic Mathematics, 7.5 ECTS cr, or equivalent

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

Upon completion of the course, students should be able to:
- use dynamic similarities and dimensional analysis in solving problems,
- explain the concepts of static, dynamic and total pressure,
- describe different ways of measuring fluid pressure, flow and viscosity,
- use the basics of statics and fluid mechanics to calculate normal force, hydrodynamic force and fluid friction,
- give an account of how fluids' properties affect their flow,
- apply the momentum equation to flowing fluids,
- interpret Bernoulli's equation, decide if it is valid for a given flow case and use it in calculations,
- calculate friction pressure drop in pipes and simple pipe systems,
- calculate the dimensions of fans and pumps for different systems,
- give an account of laminar and turbulent flows and conversion criteria,
- give an account of the "no slip" condition,
- give an account of the principles of thermal conduction, forced and natural convection,
- use Fourier's thermal conduction law for one-dimensional stationary thermal conduction,
- use heat transfer values to calculate transferred effect,

- solve convection and conduction heat transfer problems of the one-dimensional stationary type,
- calculate transferred effect for heat exchanger based on flows and temperatures on warm and cold side.

Content
The course is based on lectures and lessons. Laboratory sessions are offered.

The course comprises the following components:
-dimensional analysis
-viscosity
-pressure concepts
-hydrostatics
-ideal and viscose fluids
-incompressibility
-no slip condition
-momentum
-continuity equation
-Bernoulli's equation
-laminar and turbulent flow
-pressure losses
-boundary layer theory
-pump systems
-fan systems
-point of operation
-cavitation
-Fourier's heat transfer equation
-forced and natural convection

Reading List
See separate document.

Examination
Assessment is based on a written exam.

Grades
One of the grades Fail (U), Pass (3), Pass with Some Distinction (4) or Pass with 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 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
EMGA76 cannot be included in the same degree programm as EMGA71, EMGA74, CKGB41 and parts of EMGA73.

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