



Faculty of Health, Science and Technology
Environmental and Energy Systems

Syllabus

Applied CFD in Fluid Mechanics and Heat Transfer

Course Code:	EMGC19
Course Title:	Applied CFD in Fluid Mechanics and Heat Transfer <i>Tillämpad strömningsmekanik och värmeöverföring CFD</i>
Credits:	7.5
Degree Level:	Undergraduate level
Progressive Specialisation:	First cycle, has at least 60 credits in first-cycle course/s as entry requirements (G2F)

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

Course Approval

The syllabus was approved by the Faculty of Health, Science and Technology 2019-03-26, and is valid from the Spring semester 2020 at Karlstad University.

Prerequisites

Linear Algebra (7.5 ECTS credits) or Mathematics for Engineers II (7.5 ECTS credits), Thermal Fluid Sciences (7.5 ECTS credits) or Fluid Mechanics (7.5 ECTS credits), and Heat and Mass Transfer (7.5 ECTS credits), or equivalent

Learning Outcomes

The aim of the course is that students acquire knowledge of Computational Fluid Dynamics (CFD), including the properties and limitations of CFD, calculations of best practice for selecting models and methods, and assessment of the results in terms of quality. There is a focus on incompressible fluid flow and convective heat transfer, and students learn how to choose a suitable method for reaching a solution and how to assess the results in terms of exactness in relation to a specific technical problem.

Upon completion of the course, students should be able to:

- discuss the potential and limitations of the results of CFD simulation,
- identify and explain the terms that describe advection and diffusion in Navier-Stokes equations,
- give an account of the conservation laws for fluid flow and heat transfer,
- describe the boundary conditions of fluid flow in relation to both heat and mass transfer,
- give an account of turbulence models and how these can affect numerical solutions,
- carry out simulations of fluid flow and heat transfer, stationary and non-stationary, with CFD software,
- discuss and justify the selection of a model, its validity, limitations, and simplifications, and
- present the simulation results as vector graphs and contour graphs, and analyse them through postprocessing.

Content

The course covers the following:

- solutions through CFD simulation,
- partial differential equations, continuity-, momentum-, and energy equations for CFD simulation,
- turbulence models for selecting a simulation model,
- boundary conditions,
- mesh generation,
- assessment of error and uncertainty in CFD simulation,
- postprocessing of data for presenting the results graphically,
- CFD simulation of incompressible fluid flow,
- CFD simulation of forced convection,
- CFD simulation of natural convection.

Reading List

See separate document.

Examination

Assessment is based on a written report and an individual written exam in a computer room.

If students have a decision from Karlstad University entitling them to special pedagogical 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 Distinction (VG), Pass (G), or Fail (U) is awarded in the examination of the course. For engineering students, one of the grades 5 (Pass with Distinction), 4 (Pass with Some Distinction), 3 (Pass), U (Fail) 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.

