MJ2480 Introduction to Computational Fluid Dynamics and Mathematics 6.0 credits

Introduktionskurs strömningsberäkning och matematik

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

On 22/04/2022, the Dean of the ITM School has decided to establish this official course syllabus to apply from autumn term 2021 (registration number M-2022-0623).

Decision to discontinue this course

The course is discontinued at the expiration of the autumn semester 2023 according to a decision by the Dean of the ITM School : M-2022-0623. Decision date: 22/04/2022The course was given for the last time during autumn semester 2021. Final opportunity for examination will be given during autumn semester 2023.

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Mechanical Engineering

Specific prerequisites

ML1000 "Mathematics for engineers" 11 credits, or the equivalent

Only for TAETM

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After completing the course with a passing grade the student should be able to:

1. Account for how numerical methods should be applied in modelling of physical processes
2. Describe numerical methods that can be applied in modelling of fluid mechanics phenomena
3. Carry out numerical simulations by means of a commercial CFD tool and present the result in a report

Course contents

The following subjects related to calculation methods for heat transfer and fluid flow are treated in the course:

1. Storing of large numbers in computers (single and double precision)
2. Numerical solutions to differential equations
3. Error analysis in numerical methods (rounding, truncation etc)
4. Main equations for heat transfer in solid materials
5. Divergence theorem
6. Equations for compressible flow: conservation of mass, linear momentum and energy
7. Finite difference method for 1D and 2D heat transfer
8. Euler's solution method for transient heat transfer
9. Stability curves for explicit time marching solutions
10. Higher order time discretisation (Predictor-Corrector Scheme and Runge-Kutta method)
11. Crank-Nicolson method (implicit time marching)
12. Mesh generation
13. Advection equation and “upwind schemes”
14. Lax-Wendroff scheme
15. Introduction to solutions for inviscid flow
16. Introduction to Navier-Stokes equations and turbulence

Examination

- LAB1 - Laboratory work, 3.0 credits, grading scale: P, F
- TEN1 - Written exam, 3.0 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.