T-864-NUFF NUMERICAL FLUID FLOW AND HEAT TRANSFER 8 ECTS

Year of study:	3rd or 4th year (final year BSc or first year MSc).
Semester:	Spring.
Level of course:	3. First cycle, advanced / 4. Second cycle, introductory.
Type of course:	Elective. *Recommended elective for MSc Mechanical Engineering.*
Prerequisites:	Mathematics III (T-301-MATH); Thermodynamics (T-507-VARM); Fluid Dynamics (T-536-RENN), T-606-HEAT Heat Transfer (T-606-HEAT; may be taken simultaneously).
Schedule:	Runs for 12 weeks - 6 teaching hours a week.
Supervisor:	Guðrún A. Sævarsdóttir.
Lecturer:	Yonatan Afework Tesfahunegn.

Learning outcome: Upon completion of the course students will have a good understanding of the basic theory of CFD, including discretization, accuracy, and stability. They will be capable of writing a simple solver and using commercial and open source CFD codes.
Knowledge: After completing this course the students will have knowledge on:

- Mathematical modeling
- Classification of basic equations of fluid dynamics
- Discretization methods
- Stability and accuracy analysis
- Solution methods

Skills: After completion of this course the students will have skills on:

- Practical use and programming of numerical methods in fluid dynamics
- Setting up a given problem using commercial and open source CFD codes
- Generating computation grids
- Choosing appropriate boundary conditions for model problems
- Interpreting the results critically

Competence: After completion of this course, the students will have competence on:

- Numerical solution of model problems in fluid dynamics and heat transfer
- Checking and assessing basic numerical methods for fluid flow and heat transfer problems

Content: The main purpose of this course is to introduce the basic principles of computational fluid dynamics (CFD) for analyzing fluid flows and heat transfer. Hands on exercises are used to study the basic theory of CFD through programming and using existing commercial and open source CFD codes. Finite difference and finite volume techniques are emphasized.

Reading material: *Essential computational fluid dynamics*, Zikanov Oleg, 2010.
Teaching and learning activities: Lectures, tutorials, hands-on exercises, assignments, and projects. The course is organized into two parts.
The first part (about 60 % of the total course time) is reserved for lectures of the basic methods of CFD. It includes a programming project using Matlab.
The remainder of the course includes hands-on exercises and projects with CFD commercial grid generator (ICEM-CFD), commercial CFD software (Fluent) and open source CFD code (SU2)
Assessment methods: Programming assignments and homework 10%; Programming project 25%; Grid generation assignments 10%; CFD code assignments 15%; CFD code projects 30%; Quiz 10%; Total 100%.
Language of instruction: English.

All course descriptions may be subject to change. Revised information on the course schedule, reading material, teaching and learning activities, and assessment methods will be introduced in the learning management system Canvas at the beginning of the semester.