GHENT UNIVERSITY

# Course Specifications

Valid as from the academic year 2016-2017

## Computional Fluid Dynamics (E040520)

**Course size** *(nominal values; actual values may depend on programme)*

| | | | |
|---|---|---|---|
| **Credits 3.0** | **Study time 90 h** | **Contact hrs** | 30.0 h |

**Course offerings and teaching methods in academic year 2017-2018**

| | | |
|---|---|---|
| A (semester 1) | lecture | 15.0 h |
| | seminar: practical PC room classes | 15.0 h |

**Lecturers in academic year 2017-2018**

| | | |
|---|---|---|
| Degroote, Joris | TW03 | lecturer-in-charge |

| **Offered in the following programmes in 2017-2018** | crdts | offering |
|---|---|---|
| Bridging Programme Master of Science in Fire Safety Engineering | 3 | A |
| Master of Science in Electrical Engineering Technology (main subject Automation) | 3 | A |
| Master of Science in Electromechanical Engineering (main subject Control Engineering and Automation) | 3 | A |
| Master of Science in Electromechanical Engineering (main subject Electrical Power Engineering) | 3 | A |
| Master of Science in Electromechanical Engineering (main subject Maritime Engineering) | 3 | A |
| Master of Science in Electromechanical Engineering (main subject Mechanical Construction) | 3 | A |
| Master of Science in Electromechanical Engineering (main subject Mechanical Energy Engineering) | 3 | A |
| Master of Science in Electromechanical Engineering Technology | 3 | A |
| Master of Science in Biomedical Engineering | 3 | A |
| International Master of Science in Biomedical Engineering | 3 | A |
| Master of Science in Biomedical Engineering | 3 | A |
| International Master of Science in Fire Safety Engineering | 3 | A |
| Master of Science in Fire Safety Engineering | 3 | A |

**Teaching languages**

English

**Keywords**

Computational Fluid Dynamics, CFD, Fluent

**Position of the course**

An introduction to computational techniques in fluid dynamics

**Contents**

- Flow equations: conservation equations and state equations, mathematical character of flow equations
- Finite volume methods for diffusion and convection-diffusion: steady state diffusion, steady state convection-diffusion, central and upwind discretisations
- Higher order discretisation of convection-diffusion: quadratic upwind discretisation, non-linear upwind discretisation: TVD-schemes
- Pressure-velocity coupling: pressure oscillations, momentum interpolation, pressure correction algorithms.
- Turbulence models for viscous flows: Reynolds averaging, turbulent viscosity, two-equation eddy viscosity models, RSM and ASM, introduction to LES and DNS
- Grid generation and spatial discretisation: structured and unstructured grids, cell-

centred and vertex-based finite volume methods
- Solution methods for systems of equations: direct methods, iterative methods, multigrid formulation
- Unsteady flows: implicit and explicit time stepping schemes

**Initial competences**

Transport Phenomena

**Final competences**

1 Analyse a flow problem with a commercial computational fluid dynamics package.
2 Argue selected models, discretisation techniques, solution techniques, grid and time step size.

**Conditions for credit contract**

Access to this course unit via a credit contract is determined after successful competences assessment

**Conditions for exam contract**

This course unit cannot be taken via an exam contract

**Teaching methods**

Lecture, seminar: practical PC room classes

**Extra information on the teaching methods**

Exercises in the PC room using a commercial package, no programming.

**Learning materials and price**

Slides and course notes

**References**

[1] An Introduction to Computational Fluid Dynamics: The Finite Volume Method (2nd edition), H. Versteeg and W. Malalasekra, Pearson Prentice Hall, 2007.

**Course content-related study coaching**

**Evaluation methods**

continuous assessment

**Examination methods in case of periodic evaluation during the first examination period**

**Examination methods in case of periodic evaluation during the second examination period**

**Examination methods in case of permanent evaluation**

Report

**Possibilities of retake in case of permanent evaluation**

examination during the second examination period is possible

**Extra information on the examination methods**

Report on an exercise which has to be performed autonomously.

**Calculation of the examination mark**