

## Computational Fluid Dynamics (E045280)

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

**Credits 3.0** **Study time 90 h**

**Course offerings in academic year 2026-2027**

A (semester 1)	English	Gent
B (semester 1)	Dutch	Gent

**Lecturers in academic year 2026-2027**

Degroote, Joris TW08 lecturer-in-charge

**Offered in the following programmes in 2026-2027**

	crdts	offering
<a href="#">Bridging Programme Master of Science in Electromechanical Engineering(main subject Maritime Engineering)</a>	3	A
<a href="#">Bridging Programme Master of Science in Engineering: Ships and Marine Technology</a>	3	A
<a href="#">Master of Science in Electromechanical Engineering(main subject Maritime Engineering)</a>	3	B
<a href="#">Master of Science in Electromechanical Engineering(main subject Maritime Engineering)</a>	3	A
<a href="#">International Master of Science in Advanced Design of Sustainable Ships and Offshore Structures</a>	3	A
<a href="#">Master of Science in Civil Engineering</a>	3	A
<a href="#">Master of Science in Engineering: Ships and Marine Technology</a>	3	B
<a href="#">Master of Science in Engineering: Ships and Marine Technology</a>	3	A

**Teaching languages**

English, Dutch

**Keywords**

CFD

**Position of the course**

A fundamental introduction to the computational techniques in fluid mechanics for engineering students.

**Contents**

- Flow equations: mathematical character of convection-diffusion equations
  - Finite volume methods for convection-diffusion equations: steady state diffusion, steady state convection-diffusion, central and upwind discretisation, quadratic upwind discretisation, non-linear upwind discretisation: TVD-schemes
  - Unsteady flows: implicit and explicit time stepping schemes, stability analysis
  - Turbulence models for viscous flows: Reynolds averaging, eddy viscosity, two-equation eddy viscosity models, RSM, LES, DNS, transition models
  - 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, pressure-velocity coupling, momentum interpolation, pressure correction algorithms
- Exercise with a commercial CFD package:
- Calculate mixing of a cold and hot flow in a tube
  - Compare discretisation schemes in a cavity
  - Calculate the oscillating wake of a cylinder in cross flow
  - Compare turbulence models for a dump diffusion

**Initial competences**

Transport phenomena, Heat and flow engineering

(Approved)

**Final competences**

- 1 Describe selected techniques in computational fluid dynamics
- 2 Select appropriate numerical techniques and settings for a flow problem

**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**

Seminar, Lecture, Independent work

**Extra information on the teaching methods**

lecture, seminar: practical PC room classes, independent work

**Study material**

Type: Handbook

Name: Book

Indicative price: Free or paid by faculty

Optional: no

Type: Slides

Name: Slides

Indicative price: Free or paid by faculty

Optional: no

Type: Other

Name: Tutorials

Indicative price: Free or paid by faculty

Optional: no

**References**

An Introduction to Computational Fluid Dynamics: The Finite Volume Method, H. Versteeg and W. Malalasekera,

**Course content-related study coaching****Assessment moments**

end-of-term assessment

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

Written assessment with multiple-choice questions, Written assessment with open-ended questions

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

Written assessment with multiple-choice questions, Written assessment with open-ended questions

**Examination methods in case of permanent assessment****Possibilities of retake in case of permanent assessment**

not applicable

**Extra information on the examination methods**

Periodic (end-of-term) evaluation: written examination with open questions and with multiple choice questions (closed book).

**Calculation of the examination mark**