GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2017-2018

Fluid Mechanics (E045220)

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

Credits 6.0	Study time 180 h	Contact hrs 60.0 h

Course offerings and teaching methods in academic year 2018-2019

A (semester 2)	Dutch	guided self-study	27.5 h
		practicum	5.0 h
		excursion	5.0 h
		project	17.5 h
		seminar: coached exercises	7.5 h
B (semester 2)	English	practicum	5.0 h
		lecture	22.5 h
		project	17.5 h
		seminar: coached exercises	12.5 h
		excursion	5.0 h

Lecturers in academic year 2018-2019

Degroote, Joris	TW03	lecturer-in-charge

Offered in the following programmes in 2018-2019	crdts	offering
Bridging Programme Master of Science in Electromechanical Engineering (main subject Mechanical Energy Engineering)	6	B
Bridging Programme Master of Science in Fire Safety Engineering	6	B
Master of Science in Electromechanical Engineering (main subject Control Engineering and Automation)	6	A
Master of Science in Electromechanical Engineering (main subject Electrical Power Engineering)	6	A
Master of Science in Electromechanical Engineering (main subject Maritime Engineering)	6	A
Master of Science in Electromechanical Engineering (main subject Mechanical Construction)	6	A
Master of Science in Electromechanical Engineering (main subject Mechanical Energy Engineering)	6	B
Master of Science in Electromechanical Engineering (main subject Mechanical Energy Engineering)	6	A
Master of Science in Chemical Engineering	6	B
European Master of Science in Nuclear Fusion and Engineering Physics	6	B
Master of Science in Fire Safety Engineering	6	B
European Master of Science in Nuclear Fusion and Engineering Physics	6	B
Master of Science in Chemical Engineering	6	B

Teaching languages

Dutch, English

Keywords

Lift, compressible flow, shock wave, turbulence, unsteady flow, CFD

Position of the course

Introductory course on internal and external aerodynamics. Analysis of lift, effects of compressibility and viscosity, analysis of running waves in unsteady flows. Computational fluid dynamics (CFD): introduction and initiation with a CFD package. The package being used is Ansys CFD.

Contents

- One-dimensional applications: Compressible flow equations, sound wave, shock wave, Compressible flow in tube with variable section, friction, heat transfer
- General equations for ideal fluids: Euler equations, Transport of vorticity, vortex, Force on an object, wind tunnel measurement of force on aerofoil
- Steady incompressible potential flow: flow around a cylinder, Magnus effect, flow around flat plate with incidence, lift force of aerofoil, induced drag of a finite wing
- Steady compressible flow: perturbation potential for subsonic and supersonic flow, supersonic flow: two dimensional expansion waves and oblique shock waves, transsonic flow
- Linear isotropic viscous fluids: Navier-Stokes equations, boundary layer equations, transport equation of vorticity
- Aerofoils: experimental and computational developed aerofoils, laminar and turbulent aerofoils
- Unsteady flow: linearized Euler equations, acoustic and convective waves, Sod problem, waves of incompressible fluid in an elastic tube, fluid-structure interaction
- Computational fluid dynamics: grid generation, discretization techniques, solvers, project work
- Experimental methods in fluid mechanics: Pitot tubes, hot wire, optical flow measurement techniques
- Turbulent flow: flow instability, transition, turbulence equations, introduction to turbulence modelling

Initial competences

Transport phenomena

Final competences

1 To explain the influence of compressibility and viscosity on a fluid flow
2 To distinguish laminar and turbulent flows and to understand instability and transition mechanisms; to explain the working principle of laminar and turbulent airfoil profiles
3 To understand and explain running waves in unsteady flows
4 To compute one-dimensional compressible flow problems
5 To compute simple two-dimensional supersonic flows
6 To use a CFD (Computational Fluid Dynamics) package
7 To perform and present a CFD project on fluid mechanics

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

Guided self-study, excursion, lecture, practicum, project, seminar: coached exercises

Learning materials and price

Syllabus

References

- J. Anderson. Modern compressible flow, with historical perspective. McGraw-Hill. ISBN 0070016747
- H. Schlichting. Boundary layer theory. Springer Verlag. ISBN 3540662707.
- F. White. Viscous fluid flow. McGraw-Hill ISBN 0070697124

Course content-related study coaching

Evaluation methods

end-of-term evaluation and continuous assessment

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

Open book examination, oral examination

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

Open book examination, oral examination

Examination methods in case of permanent evaluation

Oral examination

Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible

Extra information on the examination methods

During examination period: oral closed-book exam, written preparation; written open-book exam - problems. During semester: graded oral presentation. Frequency: Once.

Calculation of the examination mark

Special conditions: participation at the project is necessary condition to pass. Weights: theory, 8/20; exercise, 6/20; project, 6/20.