| Module level | Credit points | Language | Semester |
|---|---|---|---|
| Master | 6 | English | annual |

**Module designation**

Theoretical Fluid Mechanics

**Course(s)**

1. Basics of 3D fluid flow
2. Basics of Hyperbolic Systems and Fluid Structure Interaction

| Code | Subtitle |
|---|---|
| **Person responsible for the module** | Prof. Dr. Andreas Meister, Prof. Dr.-Ing. Olaf Wünsch |
| **Lecturer** | 1. Prof. Dr.-Ing. Olaf Wünsch<br>2. Prof. Dr. Andreas Meister |
| **Workload** | 1. Workload: 90 h (15 h online presentation, 45 h private study, 30 h exercise)<br>2. Workload: 90 h (15 h online presentation, 45 h private study, 30 h exercise) |
| **Relation to curriculum** | Specialist studies, Simulation and Structural Technology, elective |
| **Type of teaching, contact hours** | Skype, virtual classrooms, online presentation, digital communication |
| **Requirements according to examination regulations** | None |

**Recommended prerequisites:** Module Fluid Mechanics

**Module objective / intended learning outcomes**

Students know how to model and calculate analytically complex and 3D fluid flow in wind energy systems.

**Content**

1. Balance of mass, momentum and energy for newtonian fluids (gaseous and liquid, formulation in integral and differential form, vortex transportation equation, acoustic phenomena)
   Turbulent flow (physical basics of turbulence, models for numerical simulations)
2. Theory of characteristics
   Fluid structure interaction

| | |
|---|---|
| **Study and examination requirements and forms of examination** | Written exam (120 min) or online oral examination (30 min) or written homework (25 pages) with presentation of the homework (30 min). The examinations are going to 75% (written homework) of the shares and 25% (presentation) in the final grade of the module. |
| **Media employed** | online script |

**Reading list**


Cebeci, T.: Analysis of Turbulent Flows. Elesevier Ltd, Oxford, 2004

Durbin, P.A.: Statistical Theory and Modeling for Turbulent Flows. John Wiley & Sons Ltd, Chichester, 2011

Heinz, S.: Statistical Mechanics of Turbulent Flows. Springer-Verlag, Berlin, 2003

Landau, L.D.; Lifshitz, E.M.: Course of Theoretical Physics, Volume 6 – Fluid Mechanics. Butterworth-Heinemann, Oxford, 2000

Pope, S.B.: Turbulent Flows. Cambridge University Press, Cambridge, 2000

Raichel, D.R.: The Science and Applications of Acoustics. Springer Science+Business Media Inc. , New York, 2006

C. Hirsch: Numerical Computation of Internal and External Flows, Part 1 and 2, Wiley.

E. F. Toro: Riemann Solvers and Numerical Methods for Fluid Dynamics , Springer.
R. J. LeVeque: Finite Volume methods for Hyperbolic Problems , Cambridge University Press.
D. Kröner: Numerical Schemes for Conservation Laws , Teubner.