PHY1352 Physics of fluids

[45h+22.5h exercises] 6 credits

This course is taught in the 1st semester

Teacher(s): Eric Deleersnijder, Eric Deleersnijder
Language: French
Level: First cycle

Aims

To be acquainted with the basic principles of fluid mechanics (kinematics; budget of mass, momentum and energy) and understand the main flow regimes, i.e. the compressible, incompressible and geophysical flows.

Main themes

Fundamentals: continuous media, Eulerian and Lagrangian descriptions, budget of mass, budget of momentum, budget of energy and entropy, non-inertial frame, dynamic similarity
Ideal flows: dimensionless parameters, acoustic waves, compressible flows, shock waves, nonlinear waves
Incompressible flows: Boussinesq approximation, energy method, 1D flows, lubrication, boundary layers, notions of turbulence
Geophysical flows: geohydrodynamic equations, dimensionless parameters, inertia oscillations, Ekman layer, shallow-water equations, Poincaré and Kelvin waves

Other information (prerequisite, evaluation (assessment methods), course materials recommended readings, ...)

Main reference
Kundu P.K. and I.M. Cohen, 2004 (3rd ed.), Fluid Mechanics, Elsevier
Additional references
Anderson J.D., 1998, A History of Aerodynamics, Cambridge University Press
Batchelor, G.K., 1967, An Introduction to Fluid Dynamics, Cambridge University Press
Frisch U., 1995, Turbulence, Cambridge University Press
McWilliams J.C., 2006, Fundamentals of Geophysical Fluid Dynamics, Cambridge University Press
Pope S.B., 2000, Turbulent Flows, Cambridge University Press
Tennekes, H. and J.L. Lumley, 1972, A First Course in Turbulence, MIT Press
Tritton, D.J., 1988, Physical Fluid Dynamics, Oxford University Press
Vallis G.K., 2006, Atmospheric and Oceanic Fluid Dynamics, Cambridge University Press
Van Dyke, M., 1988, An Album of Fluid Motion, The Parabolic Press
Whitham, G.B., 1974, Linear and Nonlinear Waves, Wiley

Other credits in programs

PHYS13BA	Troisième année de bachelier en sciences physiques	(6 credits)	Mandatory