Faculty of Science

FYTA14, Theoretical Physics: Fluid Dynamics, 7.5 credits

Teoretisk fysik: Fluiddynamik, 7,5 högskolepoäng

First Cycle / Grundnivå

Details of approval

The syllabus is an old version, approved by Study programmes board, Faculty of Science on 2012-09-10 and was valid from 2012-09-10 , autumn semester 2012.

General Information

The course is for first-cycle studies and is part of the physics main field of study at the faculty of Science and is given by the Department of Astronomy and theoretical physics. The course is compulsory for students on the Bachelor of Science programme with specialisation in Meteorology and Biogeophysics. The course can also be taken as a stand alone course.

The course is given in Swedish or when necessary in English.

Main field of studies	*Depth of study relative to the degree requirements*
Physics	G2F, First cycle, has at least 60 credits in first-cycle course/s as entry requirements
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Learning outcomes

Knowledge and understanding

On completion of the course, the students shall be able to:

- explain the origin of centrifugal and Coriolis forces
- describe the conditions for, and properties of, hydrostatic equilibrium
- explain the importance of the Reynolds number and when viscosity is important
- interpret the different terms in the Navier-Stokes equations
- at a general level explain basic properties of turbulence.

Competence and skills

On completion of the course, the student shall be able to:

- master the tools of vector calculus and be able to apply fundamental integral relations
- calculate the equilibrium for hydrostatic atmospheres
- be able to apply the laws of mechanics on continuous systems and work with velocity fields
- apply Coriolis forces on flows in rotating systems
- calculate geostrophic flow from the pressure field and judge under which assumptions this is a good approximation to the flow.

Course content

The course covers basic vector calculus and fluid dynamics with a focus on large-scale systems and flows in rotating systems. Examples and applications are mainly from oceanography, meteorology and astronomy.

In particular it includes

- vector calculus
- pressure and buoyancy, hydrostatic equilibrium
- continuum dynamics
- Bernoullis theorem, vorticity
- linear theory of hydrodynamic waves
- viscosity, Reynolds number, Navier-Stokes equations
- centrifugal and Coriolis forces, geostrophic flow, Ekman layers
- turbulence

Course design

The teaching consists of lectures, exercise sessions and hand-in assignments.

Assessment

The examination consists of hand-in assignments during the course, and a written or oral test at the end of the course.

Subcourses that are part of this course can be found in an appendix at the end of this document.

Grades

Marking scale: Fail, Pass, Pass with distinction.
To pass the entire course, approved assignments and approved examination are required.

Entry requirements

For admission to the course the following is required: general entry requirements, physics knowledge equivalent to FYSA01, General physics, 30 credits and FYSB12, Basic Statistical Physics and Quantum Statistics, 7.5 credits, as well as 37.5 credits of mathematics, including MATB21, Analysis in Several Variables 1, 7.5 credits or equivalent. English 6/English B.

Subcourses in FYTA14, Theoretical Physics: Fluid Dynamics

Applies from H12

1201 Handins, 1,5 hp
Grading scale: Fail, Pass
1202 Examination, 6,0 hp
Grading scale: Fail, Pass, Pass with distinction