FLUID MECHANICS/STRÖMNINGSMEKANIK
SG2214, 7.5 hp., 2014

Course information

Course requirements

- **INL 1 (3 hp.)**
  - **3 sets of home work problems**
    - **Homework 1 , due Sept. 15 (for max 3p. bonus on first exam)**
    - **Homework 2, due Oct. 14 (for max 5.5p. bonus on first exam)**
    - **Homework 3, due Oct 22 (for max 3.5p. bonus on first exam)**
  - **1 laboration, week 38-39**

- **TEN1 (4.5 hp.) Oct. 30, 2014**/ (Re-exam Jan 7, 2015)
  - **1 written exam (max 50+12 p. including bonus from homework 1, 2 and 3)**
  - **The grade FX is given at 19 p. including homework problems. The grade FX can be supplemented to E within six weeks after the grading is ready.**

Grades are given according to the table, which may be slightly adjusted for each exam:

Exam result R	ECTS Grade
40 ≤ R	A
35 ≤ R< 40	B
30 ≤ R< 35	C
25 ≤ R< 30	D
20 ≤ R< 25	E
R = 19	FX
R < 19	F

Literature:

Book: **Kundu & Cohen, Fluid Mechanics, (5:th ed.)**

- **useful also in SG2218 Turbulence, 7.5 hp.**
- **and in SG2221 Wave motions and hydrodynamic stability, 7.5 hp.**
- **E-book via:**
  http://www.knovel.com/web/portal/basic_search/display?_EXT_KNOVEL_DISPLAY_bookid=4380

Lecture notes via course home page
Recitation notes via course home page
Old exams via course home page

Laboration:

Experimental lab scheduled during course (week 38-39)
Investigation of laminar boundary layers with and without pressure gradients
Address: Teknikringen 8

Teachers:

Lecturer: **Anders Dahlkild, 790 9174, ad@mech.kth.se**
Instructor: **Luca Brandt, 790 7671, luca@mech.kth.se**

Course home page: **http://www2.mech.kth.se/~luca/5C1214.html**

Detailed course plan

Day	Time	Room	Teacher	Description
1. Introduction, tensors, kinematics				
Tue Sep 2	8-10	**E3**	**Anders Dahlkild**	**Lecture 1:** Introduction and motivation of Navier-Stokes eq. Kinematics: Lagrange/Euler coord., material derivative.
Tue Sep 2	13-15	**M33**	**Luca Brandt**	**Recitation 1:** Tensors.
Fri Sep 5	13-15	**D3**	**AD**	**L2:** Kinematics: relative motion.
Fri Sep 5	15-17	**V32**	**LB**	**R2:** Euler/Lagrange coordinates and relative motion.
Weekend 36				
2. Conservation laws				
Mon Sep 8	15-17	**D3**	**AD**	**L3:** Stress tensor, Reynolds transport theorem, Conservation of momentum and mass.
Tue Sep 9	15-18	**Q31**	**LB**	**R3:** Stress tensor, application of conservation equations. **Tutorial homework 1.**
3. Laminar viscous flow				
Fri Sep 12	8-10	**D3**	**AD**	**L4:** Navier-Stokes equations, examples.
Fri Sep 12	15-17	**Q36**	**LB**	**R4:** Exact solutions to Navier-Stokes equations
Weekend 37				
Mon Sep 15	15-17	**E2**	**AD**	**L5:** Rotating cylinders and Stokes' problem. **Due Homework 1**
Tue Sep 16	13-15	**V22**	**LB**	**R5:** Exact solutions to Navier-Stokes equations.
4. Laminar boundary layers				
Tue Sep 16	15-17	**E2**	**AD**	**L6:** Boundary layer equations and Blausius flow.
Wed Sep 17	15-18	**L52**	**LB**	**R6:** Boundary layers: Similarity and wake flow. **Tutorial Homework 2.**
LABORATION WEEK 38 - 39				
Thu Sep 18 – Wed Sep 24		**See lab schedule**	**Mech. lab, Teknikringen 8**	**Self-similar boundary layer laboration - FPG -**
Weekend 38				
Wed Sep 24	8-10	**E2**	**AD**	**L7:** Boundary layers with pressure gradient, separation of the boundary layer.
Thu Sep 25	8-10	**V34**	**LB**	**R7:** More boundary layers**.**
5. Conservation of energy				
Fri Sep 26	8-10	**E2**	**AD**	**L8:** Conservation of energy.

Weekend 39				
Mon Sep 29	15-18	**L51**	**LB**	**R8:** Exact solutions to the energy equation. **Tutorial Homework 2, 3**
6. Vorticity dynamics				
Wed Oct 1	8-10	**E2**	**AD**	**L9:** Vorticity dynamics, Kelvins circulation theorem.
Thu Oct 2	13-15	**E3**	**LB**	**R9:** Rankine vortex, Generation of vorticity in natural convection.
Fri Oct 3	8-10	**E2**	**AD**	**L10:** Flows at large Re, streamfunction, velocity potential, Bernoulli's equation.
Weekend 40				
Mon Oct 6	15-17	**M33**	**LB**	**R10:** Axisymmetric flows with vorticity, Hiemenz problem.
7. 2D irrotational flow				
Tue Oct 7	15-18	**E2**	**AD**	**L11:** 2D inviscid flow and the complex potential. **Tutorial Homework 2, 3.**
Wed Oct 8	8-10	**V34**	**LB**	**R11:** Bernoulli's equation, pressure in solid body rotation/irrotational vortex, stream function.
Thu Oct 9	13-15	**D3**	**AD**	**L12:** Flow past a circular cylinder with circulation, lift and drag.
Weekend 41				
Tue Oct 14	8-10	**V22**	**LB**	**R12:** Potential flow problems. **Due Homework 2.**
8. Introduction to turbulent flow				
Tue Oct 14	15-17	**E2**	**AD**	**L13:** Averaged equations for turbulent flow, Reynolds stresses, turbulent kinetic energy.
Wed Oct 15	10-12	**V34**	**LB**	**R13:** Turbulent flows.
Fri Oct 17	8-10	**E2**		**L14:** Turbulent channel flow. Summary.
Fri Oct 17	15-17	**L51**	**LB**	**R14:** Problems from old exams.
Weekend 42				
Wed Oct 22				**Due Homework 3 (labreport)**
Weekend 43				
Thu Oct 30	**9:00-13:00**	**L22,L51,L52**		**Written Exam**
New year 2014				
Wed Jan 7	**14:00-18:00**	**V32**		**Written Re-exam**