FLUID MECHANICS/STRÖMNINGSMEKANIK
SG2214, 7.5 hp., 2012

Course information

Course requirements

- **INL 1 (3 hp.)**
  - **3 sets of home work problems**
    - **Homework 1 , due Sept. 10 (for max 3p. bonus on first exam)**
    - **Homework 2, due Sept. 27 (for max 4p. bonus on first exam)**
    - **Homework 3, due Oct 10 (for max 3p. bonus on first exam)**
  - **1 laboration, week 41**

- **TEN1 (4.5 hp.) Oct. 19, 2012**/ (Re-exam Jan 8, 2013)
  - **1 written exam (max 50+10 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 41)
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 Aug 28	**08:15-10:00**	**E3**	**Anders Dahlkild**	**Lecture 1:** Introduction and motivation of Navier-Stokes eq. Kinematics: Lagrange/Euler coord., material derivative.
Wed Aug 29	**13:15-15:00**	**E3**	**Luca Brandt**	**Recitation 1:** Tensors.
Thu Aug 30	**13:15-15:00**	**B1**	**AD**	**Lecture 2:** Kinematics: relative motion.
Fri Aug 31	**08:15-10:00**	**Q2**	**LB**	**Recitation 2:** Euler/Lagrange coordinates and relative motion.
Weekend 35				
2. Conservation laws				
Mon Sep 3	**13:15-15:00**	**B3**	**AD**	**Lecture 3:** Stress tensor, Reynolds transport theorem, Conservation of momentum and mass.
Wed Sep 5	**12:15-15:00**	**D3**	**LB**	**Recitation 3:** Conservation equations, stress tensor. **Tutorial homework 1.**
Thu Sep 6	**13:15-15:00**	**E3**	**AD**	**Lecture 4:** Conservation of energy, Navier-Stokes equations**.**
Fri Sep 7	**08:15-10:00**	**D3**	**LB**	**Recitation 4:** Stress tensor and Rankine vortex.
Weekend 36				
3. Laminar viscous flow				
Mon Sep 10	**10:15-12:00**	**H1**	**AD**	**Lecture 5:** Exact solutions to Navier-Stokes equations**.** **Due Homework 1**
Mon Sep 10	**13:15-15:00**	**B3**	**Iman Lashgari**	**Recitation 5:** Exact solutions to Navier-Stokes equations.
Tue Sep 11	**13:15-15:00**	**M3**	**AD**	**Lecture 6:** Rotating cylinders and Stokes' problem.
Wed Sep 12	**12:15-15:00**	**D3**	**IL**	**Recitation 6:** Exact solutions to Navier-Stokes equations. **Tutorial Homework 2.**
Fri Sep 14	**13:15-15:00**	**B1**	**AD**	**Lecture 7:** Vorticity equation and Hiemenz problem.
Weekend 37				
4. Vorticity dynamics				
Mon Sep 17	**13:15-15:00**	**B1**	**LB**	**Recitation 7:** Exact solution of energy equation.
Tue Sep 18	**15:15-17:00**	**B1**	**AD**	**Lecture 8:** Vorticity and circulation, streamfunction, velocity potential, Bernoulli's equation.
Wed Sep 19	**13:15-15:00**	**D3**	**LB**	**Recitation 8:** Natural convection in channel, Kelvins theorem, vorticity.

5. 2D irrotational flow				
Fri Sep 21	**10:15-13:00**	**D3**	**AD**	**Lecture 9:** 2D inviscid flow and the complex potential. **Tutorial Homework 2.**
Weekend 38				
Mon Sep 24	**08:15-10:00**	**E3**	**LB**	**Recitation 9:** Bernoulli's equation, pressure in solid body rotation/irrotational vortex, stream function.
Tue Sep 25	**13:15-15:00**	**B1**	**AD**	**Lecture 10:** Flow past a circular cylinder with circulation, lift and drag.
Wed Sep 26	**10:15-12:00**	**M2**	**IL**	**Recitation 10:** Potential flow problems.
6. Laminar boundary layers				
Thu Sep 27	**08:15-10:00**	**E3**	**AD**	**Lecture 11:** Boundary layer equations and Blausius flow. **Due Homework 2**
Thu Sep 27	**10:15-12:00**	**E3**	**IL**	**Recitation 11:** Boundary layers: Similarity and wake flow.
Fri Sep 28	**10:15-12:00**	**D3**	**AD**	**Lecture 12:** Boundary layers with pressure gradient, separation of the boundary layer.
Weekend 39				
Tue Oct 2	**13:15-16:00**	**B1**	**LB**	**Recitation 12:** More boundary layers**. Tutorial Homework 3**
7. Introduction to turbulent flow				
Wed Oct 3	**13:15-15:00**	**E2**	**AD**	**Lecture 13:** Averaged equations for turbulent flow, Reynolds stresses, turbulent kinetic energy.
Thu Oct 4	**10:15-12:00**	**M3**	**LB**	**Recitation 13:** Turbulent flows.
Fri Oct 5	**15:15-17:00**	**E2**	**AD**	**Lecture 14:** Turbulent channel flow, Summary.
Weekend 40				
Wed Oct 10	**10:15-12:00**	**D3**	**LB**	**Recitation 14:** Problems from old exams. **Due Homework 3**
Mon Oct 8 – Fri Oct 12		**Mech. lab, Teknikringen 8**		**Laboration**
Weekend 41				
Fri Oct 19	**09:00-13:00**	**E1**		**Written Exam**
New year 2013				
Tue Jan 8	**09:00-13:00**	**L52**		**Written Re-exam**