

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.) Nov. 1, 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
$40 \leq R$	A
$35 \leq R < 40$	B
$30 \leq R < 35$	C
$25 \leq R < 30$	D
$20 \leq R < 25$	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 Blasius 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