

FLUID MECHANICS/STRÖMNINGSMEKANIK

SG2214, 7.5 hp., 2016

KTH-web course registration August 22 – September 1

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. 12 (for max 5.5p. bonus on first exam)
 - Homework 3, due Oct 19 (for max 3.5p. bonus on first exam)
 - 1 laboration, week 38
- **TEN1 (4.5 hp.)** Oct. 28, 2016 (Re-exam Dec 21, 2016)
KTH-web registration for exam: Sep 8 – Oct 6 (Nov 6 – Dec 4)
PhD-students register to: marcusot@kth.se Sep 8 – Oct 6 (Nov 6 – Dec 4)
 - 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.sciencedirect.com/science/book/9780123821003>

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)

Investigation of laminar boundary layers with and without pressure gradients

Address: Fluid Physics lab, Teknikringen 8

Teachers:

Lectures: Anders Dahlkild, 790 9174, ad@mech.kth.se

Recitations: Luca Brandt, 790 7671, luca@mech.kth.se

Course home page: <https://www.kth.se/social/course/SG2214>

Detailed course plan

Day	Time	Room	Teacher	Description
1. Introduction, tensors, kinematics				
Tue Aug 30	13-15	M33	Anders Dahlkild	Lecture 1: Introduction and motivation of Navier-Stokes eq. Kinematics: Lagrange/Euler coord., material derivative.
Wed Aug 31	10-12	Q36	Luca Brandt	Recitation 1: Tensors.
Thu Sep 1	10-12	Q36	AD	L2: Kinematics: relative motion.
Fri Sep 2	8-10	M33	LB	R2: Euler/Lagrange coordinates and relative motion.
Weekend 35				
2. Conservation laws				
Mon Sep 5	15-17	M33	AD	L3: Stress tensor, Reynolds transport theorem, Conservation of momentum and mass.
Tue Sep 6	15-18	L52	LB	R3: Stress tensor, application of conservation equations. Tutorial homework 1.
3. Laminar viscous flow				
Wed Sep 7	10-12	L51	AD	L4: Navier-Stokes equations, examples.
Thu Sep 8	10-12	Q31	LB	R4: Exact solutions to Navier-Stokes equations
Weekend 36				
Mon Sep 12	15-17	L51	AD	L5: Rotating cylinders and Stokes' problem. Due Homework 1
Tue Sep 13	15-17	M33	LB	R5: Exact solutions to Navier-Stokes equations.
4. Conservation of energy				
Wed Sep 14	10-12	V22	AD	L6: Conservation of energy.
Fri Sep 16	15-18	L51	LB	R6: Exact solutions to the energy equation. Tutorial Homework 2.
Weekend 37				
5. Laminar boundary layers; LABORATION WEEK 38				
Tue Sep 20 – Fri Sep 23	See lab schedule		Mech. lab, Teknikringen 8	Self-similar boundary layer laboration - FPG -
Tue Sep 20	15-17	V32	AD	L7: Boundary layer equations and Blasius flow.
Thu Sep 22	10-12	V34	LB	R7: Boundary layers: Similarity and wake flow.
Fri Sep 23	15-17	Q33	AD	L8: Boundary layers with pressure gradient, separation of the boundary layer.

Weekend 38				
Mon Sep 26	15-18	L52	LB	R8: More boundary layers. Tutorial Homework 2, 3
6. Vorticity dynamics				
Tue Sep 27	15-17	M33	AD	L9: Vorticity dynamics, Kelvins circulation theorem.
Fri Sep 30	8-10	M33	LB	R9: Rankine vortex, Generation of vorticity in natural convection.
Fri Sep 30	15-17	L52	AD	L10: Flows at large Re, streamfunction, velocity potential, Bernoulli's equation.
Weekend 39				
Mon Oct 3	15-17	M33	LB	R10: Axisymmetric flows with vorticity, Hiemenz problem.
7. 2D irrotational flow				
Tue Oct 4	15-18	M33	AD	L11: 2D inviscid flow and the complex potential. Tutorial Homework 2, 3.
Thu Oct 6 Last date for exam registration	10-12	V32	LB	R11: Bernoulli's equation, pressure in solid body rotation/irrotational vortex, stream function.
Fri Oct 7	15-17	Q33	AD	L12: Flow past a circular cylinder with circulation, lift and drag.
Weekend 40				
Mon Oct 10	15-17	M33	LB	R12: Potential flow problems. Due Homework 2.
8. Introduction to turbulent flow				
Tue Oct 11	15-17	L51	AD	L13: Averaged equations for turbulent flow, Reynolds stresses, turbulent kinetic energy.
Thu Oct 13	10-12	M33	LB	R13: Turbulent flows.
Fri Oct 14	8-10	L52	AD	L14: Turbulent channel flow. Summary.
Fri Oct 14	15-17	Q33	LB	R14: Problems from old exams.
Weekend 41				
Mon Oct 17				Due Homework 3 (labreport)
Weekend 42				
Fri Oct 28	8:00-12:00	M33, V34		Written Exam
Weekend 50				
Wed Dec 21	8:00-12:00	V34		Written Re-exam