

2011 Spring MAE 4230/5230 Syllabus

Lecturer	Prof. Jane Wang, 323 Thurston Hall, zw24@cornell.edu
Fluent instructor TAs	Dr. Rajesh Bhaskaran rb88@cornell.edu Jeremy Horwitz jah439@cornell.edu Baidurja Ray br275@cornell.edu Acmae El Yacoubi ae222@cornell.edu
Room/Times	MW 1:25 - 2:40pm, Kimball B11 T 2:55PM - 3:45PM, Rhodes 471 (for senior design credit)
Lecture Notes	J. Wang, Lecture Notes (available on course website)
Supplementary Text	D. J. Tritton, Physical Fluid Dynamics D. J. Acheson, Elementary Fluid Dynamics M. Van Dyke, An Album of Fluid Motion B. Kirby, Course Pack 2009 Press, Teukolsky, Vetterling, Flannery, Numerical Recipes
Web resources	- Fluid Dynamics Videos: - National Committee for Fluid Mechanics for Films http://mit.edu/hml/ncfmf.html - APS/DFD fluid dynamics videos: http://www.aps.org/units/dfd/videos/index.cfm
Course Website	http://dragonfly.tam.cornell.edu under Teaching/MAE4230/MAE5230 check here for office hours, lecture notes, homeworks, homework solutions announcements

Course description: Spring. 3 credits (4230) or 4 credits (5230). This course builds on the foundation of MAE 3230. Emphasis is placed on both the fundamental principles and numerical calculation of real flows using a computational fluid dynamics package. Topics covered include inviscid and viscous flows at different regimes of Reynolds number. The examples will be related to engineering and environmental applications.

Difference between 4230 and 5230

5230 students will receive 4 credits and be expected to complete a design project. 4230 students will receive 3 credits. Those taking 5230 will attend Tuesday sections. Students taking 4291 in conjunction with 4230 (so as to satisfy design requirements) will

participate in a manner identical to 5230 students — i.e. they will attend Tuesday sections and complete a design project.

Homeworks

There will be about 10 homework sets. Homeworks are to be turned in individually, but do allow for and encourage a certain amount of working with others. You will be asked to document your teamwork on the cover page on the homework.

Homeworks are due typically on Wednesdays

Exams

Midterm	3/16, in class, 90min
Final	date TBA, in class, 90min

Grades

For MAE4230:

Homeworks,	30%
Midterm	30%
Final	40%

For MAE5230 (to be finalized)

Homeworks	30%
Midterm	30%
Final	30%
Final Project	10%

Makeup assignments/exams and homeworks, late policy, regrades

Late policy. Late homeworks will not be accepted, nor will makeup exams be offered. This policy is an administrative one, and is unrelated to the reasons for why homework is late or why one misses or expects to miss an exam. Exceptions to this will be made for religious holidays. Students with religious holidays that will overlap with exams, classes, or assignments should contact Prof. Wang no later than 1 Feb 2011.

Regrade requests. Students should request a regrade in writing to Prof. Wang. Requests made in person or via email will not be considered. This request should include a description of the item in question and why it was graded incorrectly. Requests should be made within a week from the date when the exam or homework is returned.

Course Load

The self-reported workload (average of 4230 and 5230) from 2007's class was approximately 8.6 hours per week in addition to class; in 2008, 9.3 hours. In 2009, self-reported workload for 4230 was 8.7 hours and for 5230 was 10.3 hours.

Course Evaluation

The course evaluation system will be open for students to complete evaluations during a two-week period from late April to early May. You should be notified by email and this will be mentioned in class. All students are expected to complete the evaluations. During the semester, informal feedbacks will also be collected.

Course Plan (See Course Schedule for a week by week plan)

1. Flow phenomena at different Reynolds numbers (1 week)
2. Mathematical description of the flow (2 weeks)
kinematics, conservation laws, Navier-Stokes equation, dimensional analysis
3. Introduction to numerical methods and solutions (RB) (1 week)
4. Numerical solution of flow past a cylinder (Fluent) (RB) (1 week)
5. Flow past a cylinder, experimental results at different Reynolds number regimes, flow separation, transition to turbulence, lift, drag, wakes (1 week)
6. Vortices, vortex dynamics and aerodynamic forces (1 week)
7. Fluttering and tumbling plates in a fluid (1 week)
8. Numerical solution of flow past an airfoil (Fluent) (RB) (1 week)
9. Finite difference schemes for solving simple partial differential equations (2 week)
10. Stability and accuracy of numerical solutions (2 week)
11. Boundary layer analysis (1 week)
12. Turbulence/Biological fluid dynamics (optional)

Fluid Gallery

We will typically discuss one video/picture of flow relevant to the lecture of the day. If you have videos/pictures that you think are beautiful and illustrate the material discussed in the course, please email them to Prof. Wang with a paragraph describing

the physics of the visual media and explain why it should be shared with the class. If yours are selected, you get to present it. At the end of the course, we can vote for our favorite videos and pictures. There might be a little prize for the best picture.