ENSC-352 – Mechanics of Fluids – Spring Semester – Gonzaga in Florence
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(to schedule personal revisions email me for an appointment)

Prerequisites: according to the Gonzaga Spokane requirements (check on-line for details).

A note on prerequisites: Although the basics of linear algebra and multivariable calculus are not official prerequisites for the course, we will need these tools in order to describe the behavior of the fluids we study. All the necessary mathematical and physical concepts will thus be introduced during the course.

Course Description: In this course we will consider and apply basic physical and mathematical principles used in the standard continuum description of the behavior of fluids. During the development of the course it will be clear that we need representations – that is mathematical models – to describe, understand and predict natural phenomena. A mathematical model is the “translation” of a physical phenomenon in the language of mathematics, with a degree of accuracy that depends on how suitable the chosen model is.

Fluid Mechanics is a field rich in examples of applied mathematics and you will familiarize yourself with the new notions while at the same time making use of some of the mathematical concepts learned in previous classes. After an introduction about fluid characteristics and properties, you will be introduced to fluid statics and kinematics and to the elementary dynamics described by the Bernoulli equation, in order to relate, in a simple way, fluid motion and pressure distributions. Subsequent topics will include: conservation of mass, conservation of energy, conservation of momentum considering forces in moving fluids, effects of viscosity and some effects of compressibility. All these topics are governed by a set of four equations: Newton's Second Law, The Ideal Gas Law, Conservation of Mass, and Conservation of Energy.

Course Administration: The course will consist of lectures, homework problems, quizzes, 1 mid-term exam and the final exam.


At the end of each class I will assign the reading assignment due for the following class and, at the end of the second class meeting of the week, homework will be assigned. Homework will not be graded. They will be taken in part from the textbook and in part from other sources. Corrections will be highlighted to the students, possible mistakes will be explained and full explanations of the problems solutions will take place in class. Homework problems are fundamental and the students are strongly advised to spend time on them and do as many as they can.

Quizzes will be held in class approximately every two weeks (about every ten days). Quizzes will be graded and taken into consideration for the final vote. There are no make-up quizzes. The lowest quiz score will be dropped.

The final score will be the composite of the quizzes grades, the Midterm test result, and Final test result . The Midterm and the Final tests will be performed in class in two hours. The exams (not the quizzes) are open book, although only the paper version can be used.

The final numerical grades will computed as follows (the letter grades will be used only for the final score, which is comprehensive of the votes of the quizzes, intermediate and final exams):

Midterm Exam 35%
Quizzes 20%
Final Exam 45%

Course Objectives:
1. Interpret the physical significance of the components of the equations of motion for real and ideal fluids in simple cases.
2. Calculate conditions in static and flowing fluids e.g., pressure, velocity, power, shear stress, net force, etc. This requires the use of the 4 fundamental relations of fluids mentioned above.
3. Determine required experimental conditions using dimensional analysis.
4. Use of differential methods of analysis in applications to simple problems involving fluids and their properties.
5. Employ streamlines to determine pressure and/or velocity.
6. Make calculations of flow, pressure and energy losses in simple pipe systems.

**Attendance Policy:** Regular attendance is expected as well as class participation. Please arrive on time and stay for the entire class period. Please turn off (or at least silence) all cell phones during class. If you miss a class, make sure you get the notes from someone else who attended that day.