MAE 6220
Applied Computational Fluid Dynamics
Fall 2017

Course Organization/Management:

This course will be managed through the online internet course software (blackboard.gwu.edu). All of the information that you need for this course will be available to you online through this system. Assistance is available through the Office of Information Technology via email to ithelp@gwu.edu. It is your responsibility to regularly check the site for course announcements, assignments, grade records, and course information such as project descriptions and lecture notes. Hardcopies of these materials will generally not be distributed in class.

Instructor:

	Prof. Elias Balaras
Office:	SEH 3870
Phone:	x4-3326
E-mail:	balaras@gwu.edu
Office Hours:	M. 2:30–4:30pm

Textbooks:

- *Instructors notes* summarizing theory and applications covered in class will be posted periodically and prior to lecturing on the topic.
- *Computational Methods for Fluid Dynamics*, by Ferziger & Peric, 3rd Ed., Springer, 2002. This is a useful reference textbook on the topic. It will help you go deeper into some of the topics we will cover. I will not be following this textbook, however, or assign projects and homework from it.

Lectures:

Monday 6 :10pm–8:40pm.

Homework and Projects:

A number of homework assignments and projects will be given throughout the semester. Completed assignments should be submitted by email (to balaras@gwu.edu) in pdf format prior to the specified deadline. Projects will be assigned to teams (3-4 members).

Exams:

There will a midterm exam on 10/09/17.
There will a final exam (date TBD).

Grades:

Your final grade will be determined by the following components:

Homework & Participation	15%
Team Projects	45%
Midterm Exam	20%
Final Exam	20%
TOTAL	100%

Academic Integrity:

Students can work collaboratively on homework in order to learn together but homework submission should reflect an individual effort. Strict copying is not permitted. Exams must reflect only your individual effort. Only materials permitted by the instructor are allowed to be used during the exams.

Philosophy:

The goal of this course is to provide an environment for the students to become proficient in solving fluid mechanics problems utilizing computational fluid dynamics tools. In particular we will:

- Use fundamental examples to illustrate how to select appropriate models for different problems.
- Learn how to select appropriate solution strategies for different models.
- Get hands-on experience on the above utilizing a comercial CFD solver.

The specific topics to be learned are outlined in this syllabus. Our goal is to use diverse teaching methods including visual, verbal, and other multi-media techniques to aid you in understanding the concepts.

Time you are expected to devote to this class:

You are expected to spend 2.5 hours per week on direct instruction (aka class time) and 5 hours per week on independent learning (aka homework and project).

Learning Outcomes:

- Understand the potential and limitations of CFD.
- Utilize commercial CFD software in a competent and critical manner.
- Expand your ability to conduct simulations of fluid dynamics problems, as well as to analyze and interpret data.
- Enhance your ability to communicate effectively through the written reports on the projects assigned throughout the semester.
- Enhance your ability to learn new material on your own through the problem-based learning aspects of the semester projects.

How will I use this professionally:

The technical matter on computational fluid dynamics taught in this class is directly used for solving a variety of practical engineering problems at corporations and government laboratories. The training on utilizing commercial CFD tools is also invaluable for later professional work.

SYLLABUS

We will cover the following topics:

- Governing equations and boundary conditions.
- Numerical approximations; Discretization of the governing equations; Anatomy of a CFD solution
- Introduction to commercial CFD solvers; Hands-on tutorial using Fluent
- Fundamentals of numerical analysis: consistency, stability and convergence
- Grid generation in complex geometries; Hands-on tutorial on grid generation with Fluent
- Complex geometries: Finite difference and finite volume methods
- Turbulence modeling in complex flows