

**Instructor:** Leigh Little, Ph.D.  
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**Office Hours:**  
TR 12:00 - 2:00  
And by appointment

**Textbook:**

- \* *Computational Techniques for Fluid Dynamics, Vol I*, C. A. J. Fletcher.
- \* Supplementary materials as distributed in class.

**Description:**

Computational Fluid Dynamics (CFD) comprises a critical portion of the engineering design calculations in many areas including aerodynamics, long term environmental analysis, oceanography and space dynamics. Problems arising in these areas are far too complex to be handled by analytical methods and numerical computation must be used. Further, the problems to be investigated are typically very large (on the order of 1 million unknowns or larger), requiring the use of sparse storage and solution techniques and/or parallel computation. This course will provide an introduction to the basic methods employed in the numerical solution of the equations of fluid dynamics for both compressible and incompressible flows

**Objectives:**

At the completion of this course you will be able to:

- Understand the basic equations of fluid dynamics.
- Understand the idea of dimensional analysis and similarity.
- Use MATLAB, FORTRAN and/or C to program fundamental numerical methods.
- Use basic ideas in finite element and finite difference discretization schemes.
- Understand the concept of stability of numerical processes.
- Present graphical results of numerical simulations.

**Topics:**

1. Vector Calculus
2. Equations of Fluid Mechanics
3. Dimensional Analysis and the Buckingham II Theorem.
4. Finite Difference Methods

5. Finite Element Methods
6. Stability of Discrete Solution Methods
7. Graphical Presentation of Simulation Results

**Grading:** The homework assignments are broken down into two categories as:

- 60% Homework assignments (around 6 to 10, 10 points each)
- 35% Two take-home projects (30 points each)
- 5% Attendance ((1 point on regular class days, 5 points on computer lab days).

Your final weighted average will be determined using the weights indicated and your grade will be determined according to the following scale

Average	Grade	Average	Grade
100-95.0	A	74.0-76.9	C
94.9-90.0	A-	70.0-73.9	C-
87.0-89.9	B+	67.0-69.9	D+
84.0-86.9	B	64.0-66.9	D
80.0-83.9	B-	60.0-63.9	D-
77.0-79.9	C+	< 60.0	E

The instructor may administer quizzes in class (announced or unannounced) at any time. These will be included with the take-home project scores. This will almost certainly be done if significant numbers of students fail to submit homework assignments on a timely basis or produce a very low quality of work.

Occasionally, the class will meet in one of the Dailey Hall computer labs. Students will be informed of such meetings at least one day in advance.

This is a swing level course, therefore, students taking this course at the graduate level will be required to do additional work and will be expected to produce a higher quality of work.

**Assignments:**

Homework assignments given in class will usually be due 2 weeks after they are assigned. These assignments typically involve analytical investigation and computer programming. Late assignments will be penalized at a rate of 25% per day. No assignments of any type will be accepted after the final class meeting day. Students may meet together in small groups to discuss aspects of a given assignment, but all work presented must be your own.

As the semester proceeds, all assignments will need to be produced using document processing software as MS Word or L<sup>A</sup>T<sub>E</sub>X . When computer output is requested, provide printouts of the programs and other material as requested. Do not submit large volumes of printed data.

**Policies**

I would appreciate hearing from anyone in the class who has a special need which may result from a disability. I am sure we can make the necessary arrangements, be it special seating, testing, or other accommodations.

**Attendance:**

You are expected to attend all classes. Some of the material may not be contained in the textbook. If you miss a class, it is your responsibility to get class notes and handouts and find out what you missed. The instructor reserves the right to fail any student who acquires more than 4 unexcused absences.

No incompletes or withdrawals will be given for this course except in cases of illness, personal tragedy, or extraordinary circumstances beyond the student's control, and then only if documented to the instructor's satisfaction.

Here is the official SUNY Brockport Attendance Policy:

*The student is responsible for all assigned course work and cannot be absolved of this responsibility. When enrolled in a particular course, the student is obligated to do all of the work assigned. Punctual and regular attendance is vital to the discharge of this obligation. Absences, excused or not, do not alter this responsibility. Absences deemed excessive by the instructor may result in a lowered grade. Students whose unexcused absences exceed 15% of the scheduled classes and laboratories will be subject to failure at the instructor's discretion. Absences will be excused for (a) documented illness, (b) official representation of the college, (c) death of a close relative, (d) religious holiday, and (e) circumstances beyond the control of the student. Excuses for official representation of the college must be obtained from the official supervising that activity or event. Policies regarding absences from quizzes, exams, and laboratory sessions will be at the discretion of the instructor. Substantiation of excused absences is, in any case, the responsibility of the student. Regulations more restrictive than those stated above may be established by the instructor.*

**Authorship:**

When you turn in an assignment, you are certifying it as your own work. Submitting material as your own work that is not entirely of your own authorship, or knowingly providing an answer to another person constitutes cheating. If I am convinced beyond a reasonable doubt that cheating has occurred, the person(s) submitting the illicitly obtained answer, and any person(s) knowingly providing same, will receive a grade of zero for that assignment. Further disciplinary procedures may also be considered.

**Buckley Amendment:**

The purpose of the Buckley Amendment is to protect the confidentiality of your grades. This law states that I cannot reveal any information regarding your performance in the course to anyone other than yourself and authorized college administrators without your written permission.

**Disclaimer:**

Announcements given in class are considered official addenda to this policy. All policies described are subject to change as the situation warrants. Should changes be necessary, all students will be notified in a timely fashion.